August 3, 1911

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American Machinist

A Practical Journal of Machine Construction

Issued Weekly by the Hill Publishing Company : : : 505 Pearl Street, New York

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Advertising Index 67

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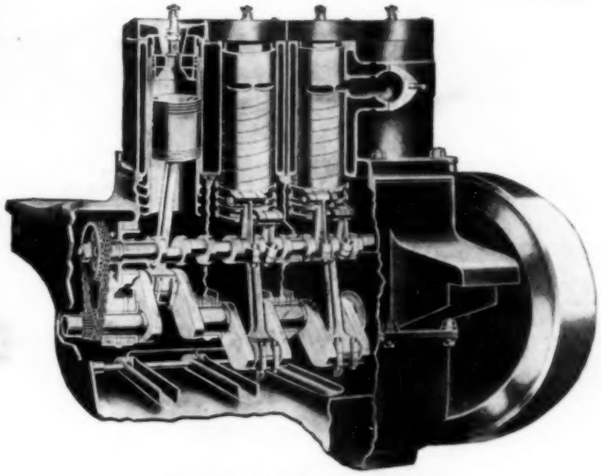

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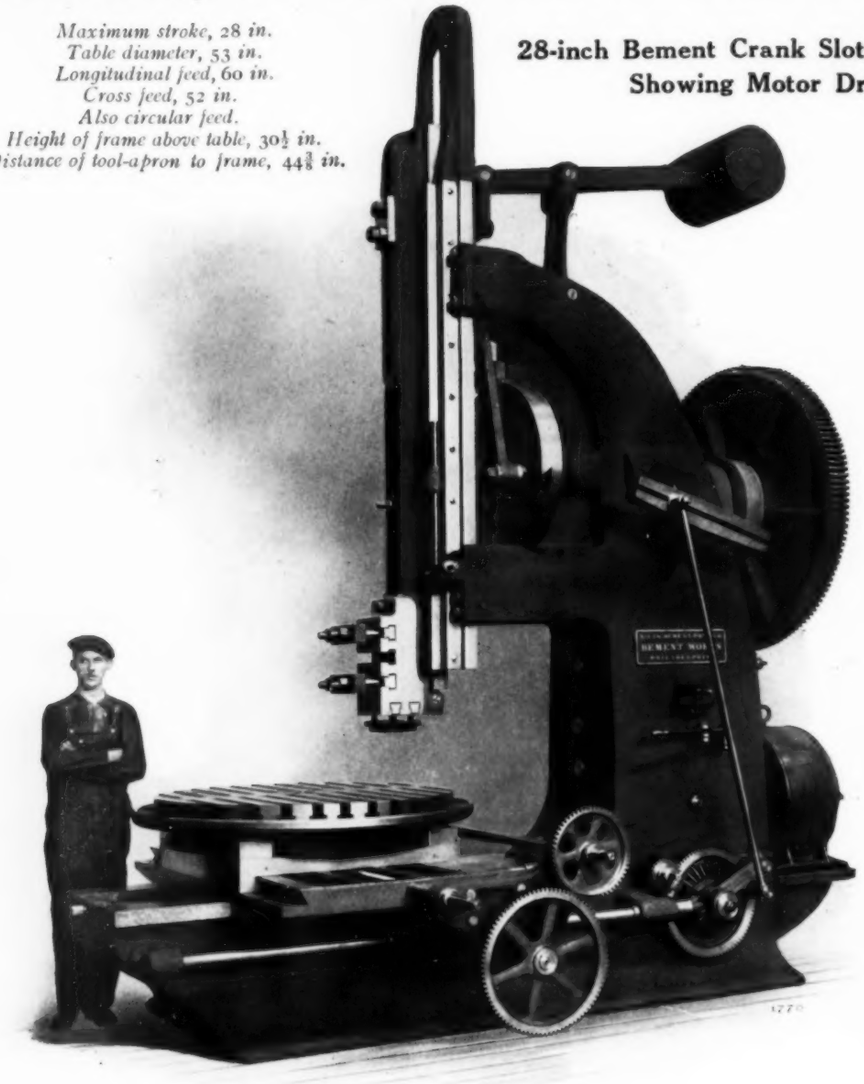

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(*See pages* 59, 60, 61, 62, 63 *and* 64)

New Lozier Factory and Methods

Western Correspondence

A new plant with interesting features of construction and novel methods of handling work in connection with the production of a high-grade automobile.

Internal-grinding processes, milling operations on connecting rods, drilling and boring fixtures and cam-grinding attachments.

The main shop buildings of the Lozier Motor Company's new plant at Detroit, Michigan, consist of a two-story building of hollow brick, steel and concrete, 720 feet long by 60 wide, and a steel and concrete saw-tooth building measuring 540 by 140 feet. The two buildings are so located on a large tract of land that the saw-tooth shop may be easily extended to any depth required by removing the rear wall, and adding the necessary number of bays; and the wings of the two-story structure, which extend past the ends of the saw-tooth building may also be increased in length indefinitely as trade conditions may require. With either shop the additional capacity necessary is obtainable without deranging the organization of the present plant or upsetting the existing departments, as these will expand naturally in the direction of the plant extensions without conflicting with one another as each increases its capacity.

FIG. 1. MUSHROOM COLUMN CONSTRUCTION IN LOZIER SHOP

Practically all of the machine work is attended to in the saw-tooth shop, the two-story building being occupied by shop offices, and restaurant, automobile body departments, painting department, final assembling room, shipping department, etc. This building is erected under the Kahn system of "mushroom" column construction with flat ceiling and with mushroom or flaring columns of the form represented in Fig. 1 which is a view in the body department where a room several hundred feet in length was photographed to illustrate the free overhead space, the lighting effect secured and the neat appearance in general which is presented by this construction.

CONCRETE REINFORCEMENT

A typical interior column is shown in Fig. 2 and this in conjunction with Fig. 3 will illustrate the method of building up the combination spiral and vertical reinforcement for the columns, with the system of horizontal rods laced between the hoops around the different column heads, in place of I-beams. The columns are spaced 20 feet apart in each direction, and the floors are designed to carry a live load of 225 pounds per square foot. In both buildings the concrete floors are covered with tar felt and heavy maple flooring. In the case of the saw-tooth building 1⅜-inch "ship lap"

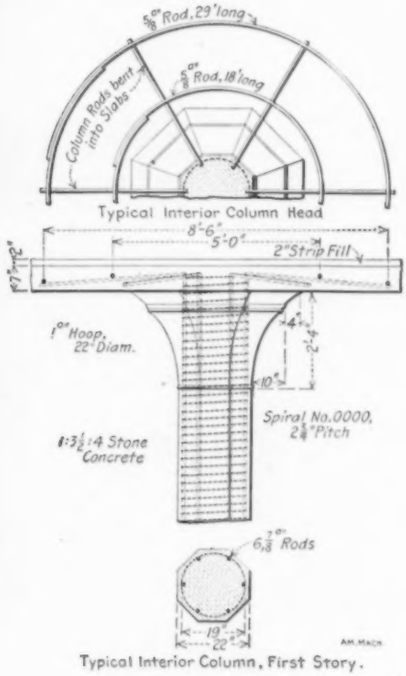


FIG. 2. COLUMN DETAIL

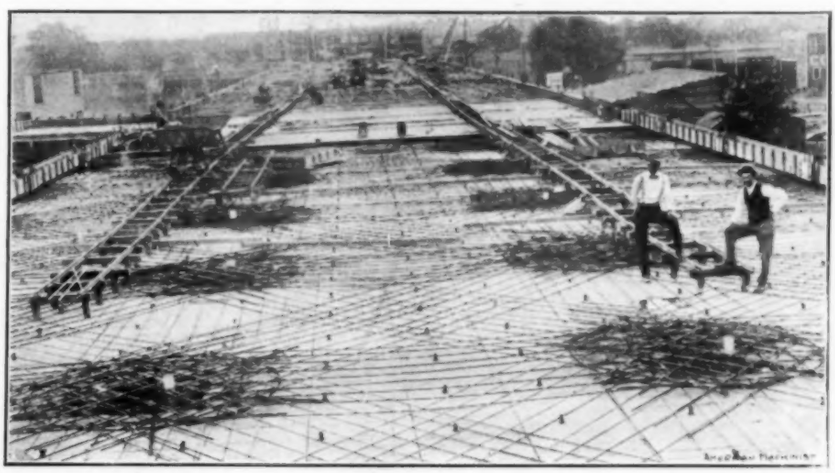


FIG. 3. METHOD OF REINFORCING

Norway pine is nailed diagonally on sleepers embedded in the concrete and the maple flooring laid over this.

Method of Heating

Water pipes, wires, etc., are for the most part carried in conduits under the floors. Heating of the saw-tooth shop is accomplished by blowing air over hot water coils and distributing the heated air through ducts or pipes which are passed through the roof as shown in Figs. 4 and 5, the latter view showing the work under construction. The ducts are of concrete where they pass outside from saw tooth to saw tooth and the air passage is lined with non-conducting material to prevent heat radiation. This arrangement carries the large rectangular ducts up out of the way where they do not interfere with light or shafting. An outlet for the air is provided in the center of each saw-tooth span.

The general view of the machine shop, Fig. 4, also shows the steel columns, which are 8-inch H-sections; the pairs of channels forming the bottom chords of the roof trusses under which the line shaft hangers are carried so as to admit of ready adjustment; the channels supported crosswise for carrying the countershafts which are also adjustable at will; and finally the method of mounting the motors overhead for the different lines of shafting.

Fig. 4. General View in Machine Shop, Showing Hot-air Duct through Saw-tooth Roof

Arrangement of Departments

From the time the raw material enters the stock room at the end of the shop until the body is on the chassis and the car is ready for shipment there is an orderly progression of the work from one department to the next and from one end of the factory to the other. The material is withdrawn from the stock room to the machine shop and the parts as finished pass through the inspection department into the finished stores from the other side of which they are withdrawn as required for the assembling and erecting department. After the motors have been erected and tested they are mounted on the chassis and the skeleton car given a thorough test on the road. The motor is then overhauled, inspected and cleaned, and after the body is mounted the car is given a final road test preparatory to shipment.

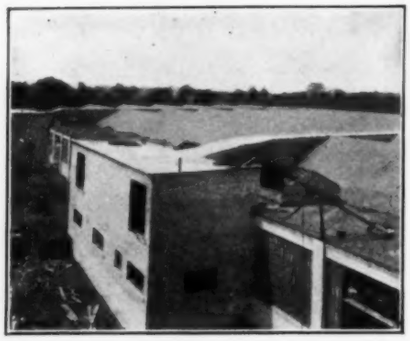


Fig. 5. Hot-air Ducts through Saw Teeth under Construction

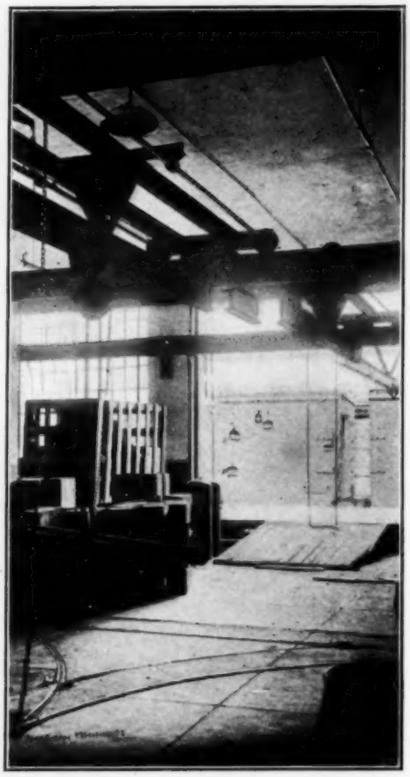


Fig. 6. Crane System for Stock Room

Handling Material in the Stock Room

Fig. 6 shows the overhead system by which material is transferred from the railroad track to the stockroom. There are two parallel craneways crosswise of the shop at this point and between them is a transfer rail for the passage of a trolley from one to the other. An I-beam also extends out over the platform

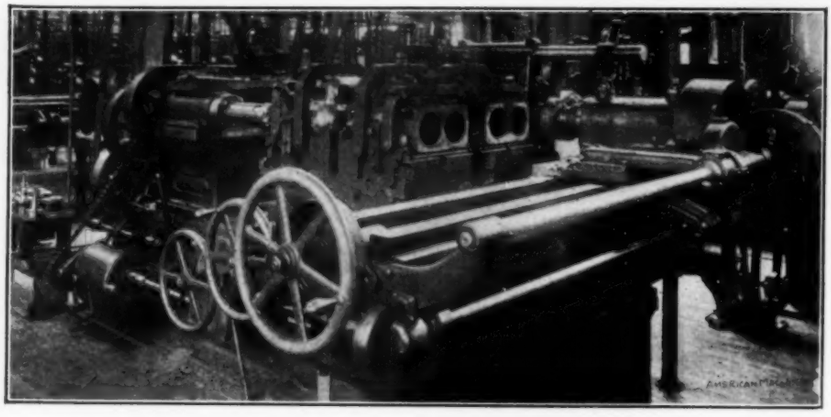


Fig. 7. Boring and Facing Cylinders

and a bar of stock or other material may be picked up by the hoist and the trolley run onto the rail under the first crane or across the transfer section to the second crane. In the photograph the two cranes are shown a little out of alinement with the short rail in order to illustrate the scheme more clearly.

Boring and Facing Cylinders

The cylinders of the Lozier engines are made in pairs and in Figs. 7 and 8 two views are presented of the method of milling the faces and boring the castings on a Beaman & Smith double-end machine with swiveling table.

The milling head feeds crosswise of the table and after four sets of castings have been placed in the fixture the faces of two pairs of cylinders are milled off and then the indexing fixture is turned half way around to bring these cylinders in position for boring and the other two into position for facing with the milling head. The boring is accomplished with a pair of heads which bore one cylinder of each pair at a time. Two cutters are run in for each bore and afterward doming cutters are put on the bars to finish the bottom of the bore. A little stock is left in the bore for finishing by grinding.

Unusual Grinding Operations

The Heald grinders in Figs. 9 and 10, are shown on some interesting operations. In the first instance the machine is fitted up with fixtures for holding pistons for the grinding out of the wrist-pin holes. The pistons are located by plugs in the fixture base and the position of the hole for grinding is gotten by slipping a locating plug into the opposite hole at the rear. The plug is then withdrawn and the grinding wheel run straight through both holes in the piston.

The view in Fig. 10 shows the same type of machine finishing the bore of cams which are secured to an angle plate on the table. The locating in this case is also done by means of a plug through the fixture, and the cam is held by a strap and nurled nut.

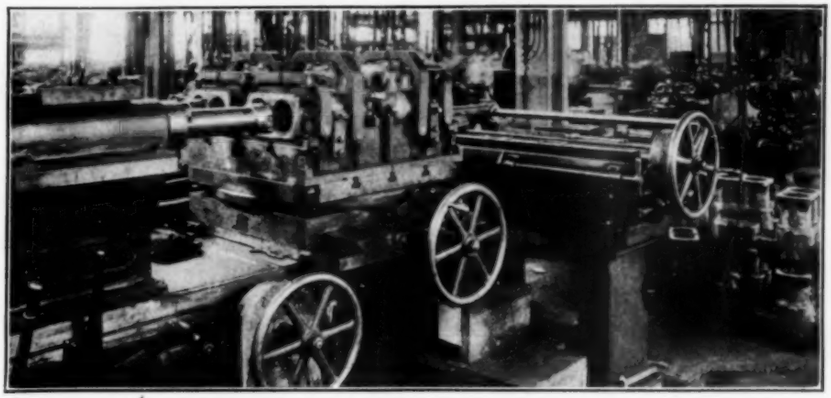


Fig. 8. Boring and Facing Cylinders

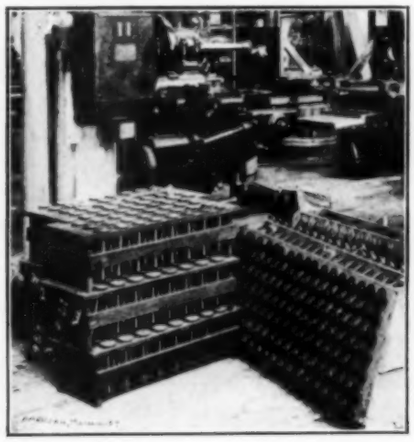


Fig. 16. Rack for Valves

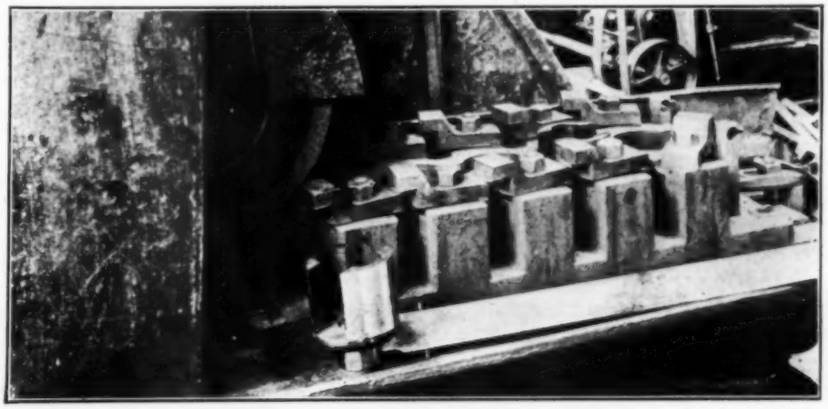


Fig. 11. Grinding Jaws of Universal Joints

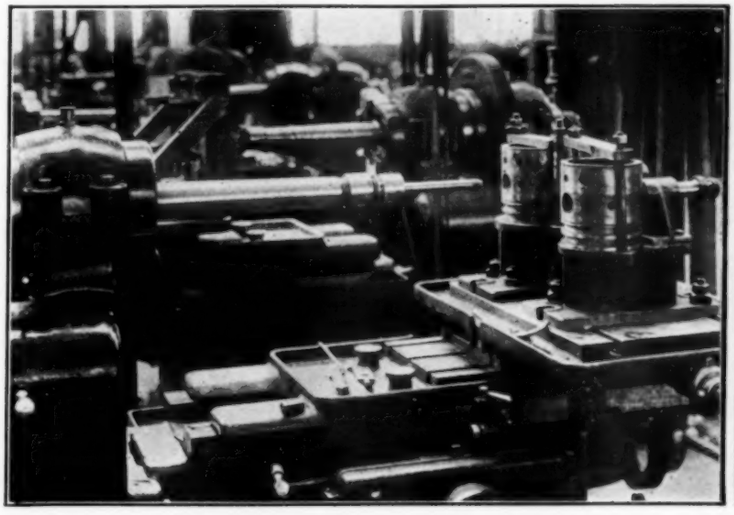


Fig. 9. Grinding Wristpin Holes in Pistons

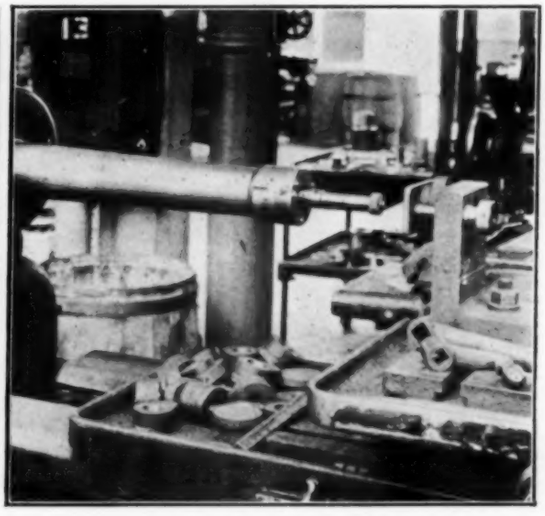


Fig. 10. Grinding Out Cams

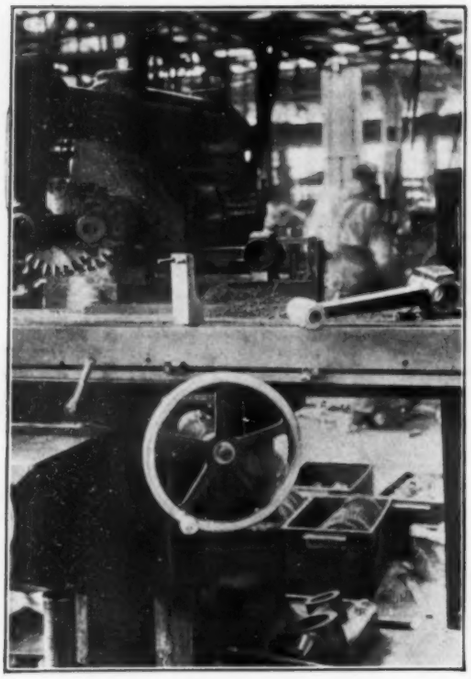


FIG. 12 MILLING CONNECTING RODS

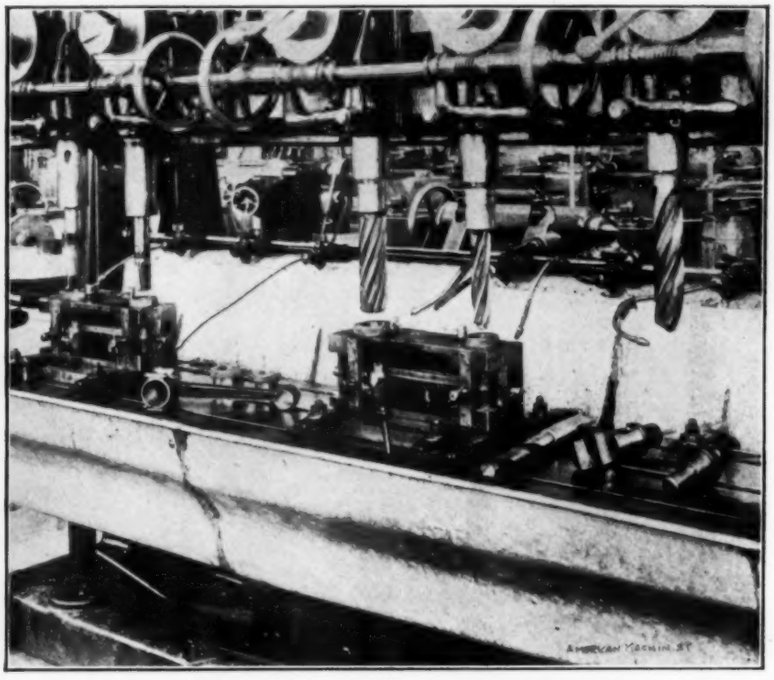


FIG. 13. BORING CONNECTING RODS

ANOTHER GRINDING OPERATION

Fig. 11 shows how the jaws of universal joints for transmission shafts are ground out to give the desired width of opening. The fixture on the table of the Diamond grinder holds five of the joint members but only one is seen in position as the machine was not in operation at the time the photograph was secured.

The work fits nicely in cylindrical chambers in the fixture and is held by straps from each side. The fixture is provided with a channel from one end to the other to clear the wheel and the wheel is applied first to one jaw of the work and then to the other.

The method of jig drilling and milling the stock from the work leaves very little material for the grinder wheel to remove after the piece is hardened, and a few passes of the table to and fro are usually sufficient to complete the job.

CONNECTING ROD WORK

Fig. 12 illustrates a method of milling sides of connecting rods. The drop-forged rod is placed in the fixture on the Cincinnati miller and clamped, and then one side of the small end is milled with one of the pair of straddle cutters and both sides of the crank end are milled at the same pass of the work. The rod is then placed on a locating stud on the Pratt & Whitney vertical surface grinder, and the surface on the small end already milled is ground. Using the same side of the crank end as a locating surface and the ground side as a gaging surface, the rod is next placed on the miller and the second side of the small end milled.

Following this, both ends are rough bored in fixtures on the Cincinnati-Bick-

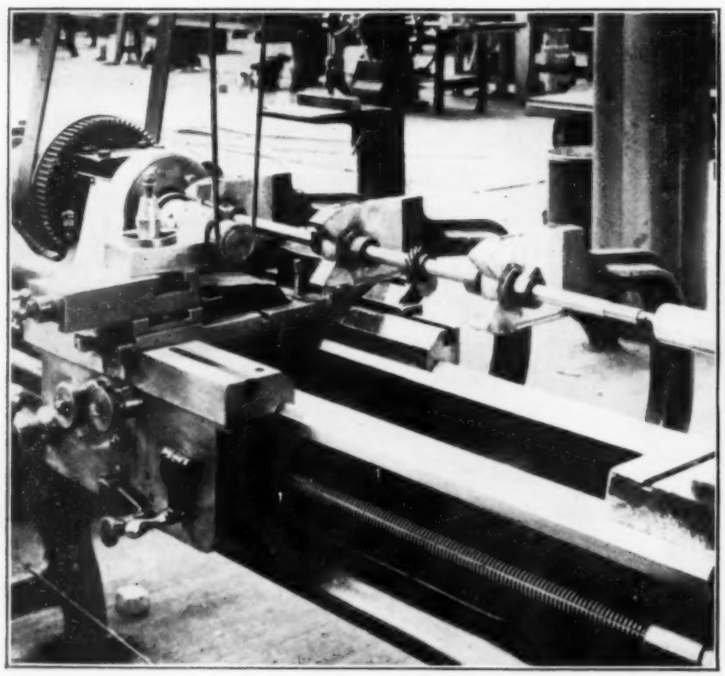


FIG. 14. CAM-GRINDING ATTACHMENT ON THE LATHE

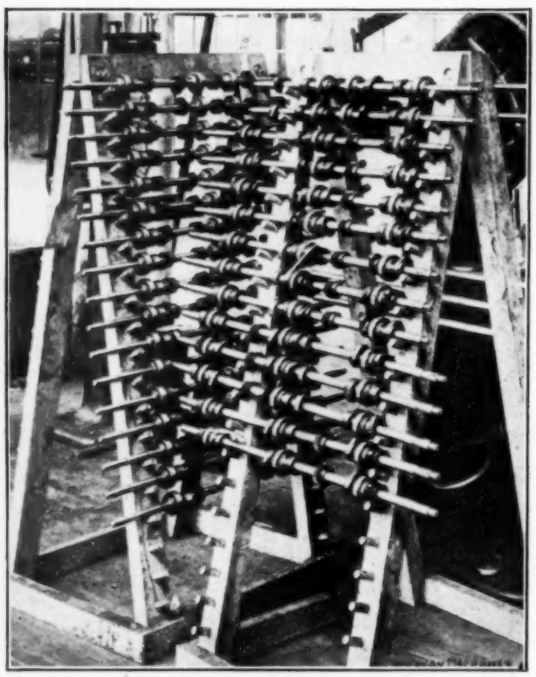


FIG. 15. CAM-SHAFT RACKS

ford 5-spindle machine in Fig. 13. Next, the miller is resorted to again to mill the bosses on the head of the rod, and form mill the circular outline of the top and edges of the rod end. After this the cap bolt holes are drilled and then the cap is cut off from the rod.

The cap seat must be milled to receive the cap, and when the two parts are assembled the rod goes back to the five-spindle drill for finish boring and for reaming to receive the bushings, a bronze bush being fitted in the wrist end and a white bronze bushing in the crank end.

The fixtures used in this process are shown clearly on the table of the machine in Fig. 13. The spindle at the end is used for roughing out the holes and the tools in the next two spindles prepare the holes for reaming, an operation which is accomplished with the fourth and fifth spindles. Two jigs are employed and these are equipped with the necessary bushings for the different tools and with half-plugs for adjusting the jig to locate the work endwise to the exact center line of the milled joint between rod and cap.

The jigs are used successively in the three positions under the spindles and are shifted from one place to the next for the different operations. The bushings, after they are pinned in place, are finally sized by hand reaming or by pushing through a sizing plug.

Grinding Cam Shafts

The cam shaft, like the crank shaft of this motor, runs in ball bearings. The cams are hardened and pinned on the shaft and then accurately ground by an attachment on the Lodge & Shipley lathe, Fig. 14. This carries a special faceplate for indexing the shaft for the cam positions and the cross slide with the grinding head attached is moved to and fro to give the cam the desired form, by means of a device at the rear of the bed which is controlled by a master cam. There is, of course, a separate master for outlet and inlet cams.

The rack in Fig. 15 is used alongside the lathe for convenience in handling these cam shafts.

Another convenient appliance for holding work is seen in Fig. 16. The valves are produced in large quantities and in handling them during grinding or other operations the racks illustrated are found useful for keeping the material in good condition and enabling it to be moved about with ease.

For the period of 11 months, ended with May, 1911, the imports of machinery into the United States amounted to $6,900,000, as against $8,200,000 for the same period of the previous year. During the month of May, 1911, there was imported $700,000 worth of machinery, and the same month of 1910 shows a similar figure.

Hydraulic Rivet Breaker for Draw Heads

The illustrations show a very interesting hydraulic machine built by B. H. Hawkins, of the East Buffalo shops of the Delaware, Lackawanna & Western railroad. This is a vertical hydraulic press having 2-, 4- and ½-inch round wrought-iron upright, the lower or operating ram having a 6- and 9-inch piston under it as shown in the complete machine at the right of Fig. 1. All details necessary for the construction of such a machine are shown in this figure.

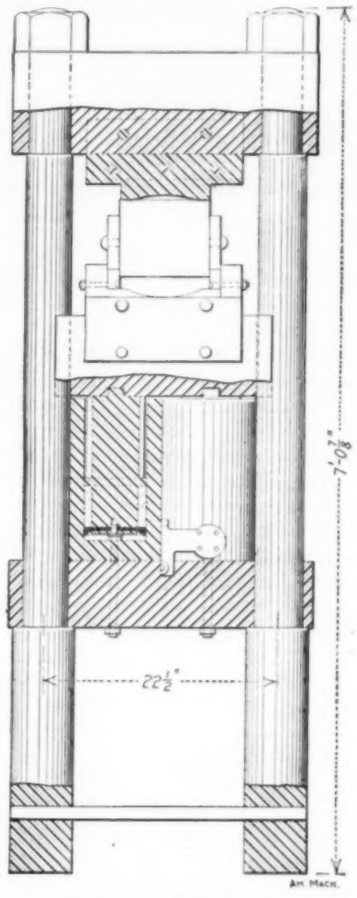


Fig. 1. Hydraulic Press for Shearing Rivets on Draw Heads

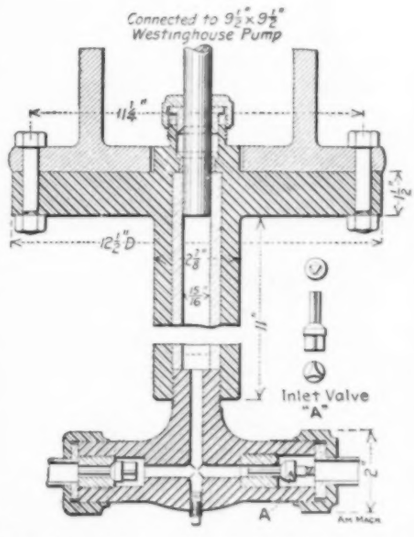


Fig. 2. Details of Pump Connections

Fig. 2 shows a hydraulic pump which has a 15/16-inch plunger and is connected to a 9½x9½ Westinghouse air brake pump, which can be operated by either steam or air. Air is used in this case with 80 pounds pressure and gives about 200 tons total pressure on the press. The old coupler is placed in the press as indicated and a foot pedal controlling the valve, admits pressure under the ram, which forces the yoke up and shears the rivet.

A Loose Pulley Trouble

By F. C. Terry

Some five or six years ago, I saw in the American Machinist a cure for the loose-pulley trouble, which consisted of a drilled bush, the holes being fitted with leather or hardwood plugs which allowed sufficient oil to pass through for lubricating, the chamber holding enough oil for several weeks' use.

This I found most successful and I have been curing my loose pulleys with it ever since. But that it is possible to carry a good thing too far the following will show. We were supplying a machine which was used for a certain process on the food of man in the far East and it was necessary to keep oil from the inside of the machine to prevent adding an unnatural taste. I decided to supply this bushing to the loose pulley as the ideal for this class of work, as if care is used no trace of escaping oil can be found, and we were somewhat surprised when our agents wrote asking us to discontinue its use and inclosing the following letter from a client which speaks for itself.

"De machine am nice running bydem not de play wheel, witch am short ob de cap an lid fur de palm fat. It am de bydem close pick job cleering de oles to gide de ile an bydem wil it now stop butt in de meale witche am de bad tast in de mouth so usless.

"Bydem I stop de ile it am de elephunt fur beste noize wile de palm am de meale gud de bil wil you ce fyve lbs. less witche I send in return by cap an lid bydem or nebber."

Needless to add Sambo got his grease cup for the palm grease and we adopted it for "giding" the lubricant of all machines made from that date.

The Aichiken Commercial Museum is now in full blast at Nagoya, Japan, with a wide range of exhibits. While this dates back to 1878 the present museum is practically a new institution, for which T. Yamagochi is the director.

Graphical Design of Helical Springs

By B. C. Batcheller *

Preliminary laying out to determine maximum and minimum extension and compression previous to application of formulas for coil details.

*Chief engineer, New York Pneumatic Service Company.

There is no device more generally used in machinery than the helical spring, and when properly designed, none is more reliable. It is common practice to use springs that are not properly designed, subjecting them to strains beyond those which they are capable of bearing, or making them of such length that the variation in force which they exert is beyond the limits that should be established. All of this occurs not for want of a reliable formula and tables, for those to be found in the AMERICAN MACHINIST of August 18, 1892, and in Kent's handbook, leave nothing to be desired. A little preliminary computation is usually required to establish the necessary data in order to use these formulas and tables, and it is with this preliminary computation that we are concerned in this article.

In designing machinery in which a spring is required, the designer usually knows the length of movement of the spring, the force that the spring should exert at some point in its movement, say at the beginning, and the variation in force that is allowable throughout its movement. This is his fundamental data. Now, before he can use the spring formula or tables, he must ascertain by computation the total compression or extension of the spring. In case the spring is free at one end of its movement, no such computation is required, but such is not usually the case.

Fig. 1 represents a spring, to be used in compression, exerting a minimum force p_1, a maximum force p_2, with a movement in length D. We wish to know the total amount of compression A. On the horizontal line $X\,X$, erect two perpendiculars, p_1 and p_2, of as many units in length as the respective forces, and distant apart, D. Through the upper ends of the two perpendiculars, p_1 and p_2, draw an inclined line, producing it until it intersects the base line at O. The distance A from the point O to the perpendicular p_2, is the total amount of compression of the spring. By similar triangles.

$$\frac{A}{D}=\frac{p_2}{p_2-p_1},$$

therefore

$$A=\frac{p_2 D}{p_2-p_1}.$$

Knowing A and p_2 we are now prepared to use the formula or tables of springs above referred to.

Fig. 2 shows a similar diagram for a spring in extension. It is obvious that p_1 can never equal p_2; in other words, we cannot make a spring to exert a constant force through a sensible length of movement, and the less the difference between p_2 and p_1, the greater must be the total amount of compression or extension.

Such a diagram and computation should be made of every spring, no matter how insignificant, for they give a clear idea of the limitations of the case in hand.

Take one or two examples. Suppose we require a spring to lift a telephone hook, shown in Fig. 3.

Let the effective weight of the receiver and hook on the spring be 18 ounces, and the limit of movement of the spring, D, ¼ inch. In order to have about equal forces to move the hook up and down, let the tension of the spring when the hook is up, p_1, be 9 ounces, and when the hook is down, p_2, be 10 ounces; then $p_2-p_1=1$ oz.

The total extension of the spring will then be

$$A=\frac{10\times\frac{1}{4}}{10-9}=2\tfrac{1}{2}\ \textit{inches}.$$

We now know that we must have a spring of sufficient length, diameter, number of coils and size of wire to exert a pull of 10 ounces when extended 2½ inches, and to bear this extension without fracture or permanent set. We can ascertain the dimensions from the formula or tables already referred to

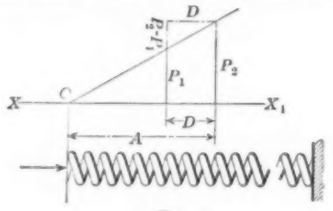


FIG. 1

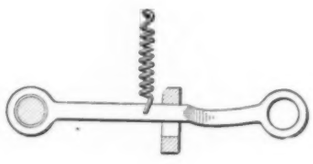


FIG. 3

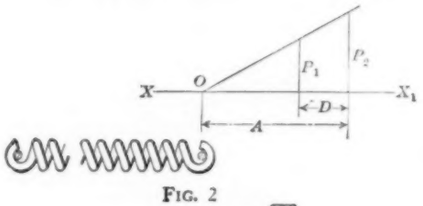


FIG. 2

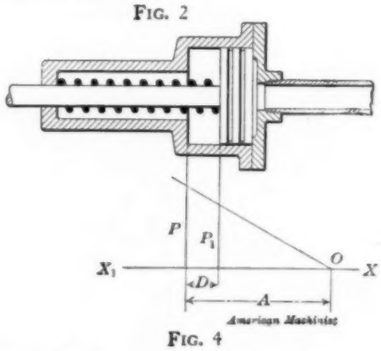


FIG. 4

DESIGN OF HELICAL SPRINGS

Another example. Suppose we require a spring to move a piston in one direction that is moved in the opposite direction by a definite fluid pressure, Fig. 4. Let

$p_1=150$ pounds,
$p_2=175$ pounds,
and
$D=1\frac{1}{4}$ inches.

$$A=\frac{175\times 1\frac{1}{4}}{175-150}=8\tfrac{3}{4}\ \textit{inches}.$$

We must have a spring of sufficient length, diameter, number of coils and size of wire to bear a total compression of 8¾ inches, and exert a force of 175 pounds under this maximum compression, without injury to the spring.

Instead of specifying all of the dimensions of a spring, better results will be secured by specifying the free length, outside diameter and force to be exerted when extended or compressed a given length, leaving the size of the wire and number of coils to be determined experimentally by the spring maker. When the total amount of extension or compression has been determined by the method described above, in the case of small springs that are used well within their limits of elasticity, the free length and diameter of the spring can be chosen with judgment, acquired by experience, without reference to formula or tables. In the case of the spring for the telephone hook, it can be specified as follows: Free length, 3 inches, outside diameter, ¼ inch, to exert a pull of 10 ounces when extended to a length of 5½ inches, leaving the size of wire and number of coils to be determined by the spring maker.

In the case of the spring to move a piston, specify free length 20 inches, outside diameter 2¼ inches, to exert a force

of 175 pounds when compressed to a length of 11¼ inches, diameter of wire and number of coils to be determined by the spring maker.

Frequently the designer is limited as to space in which to place a spring. In such cases he cannot depend entirely upon his judgment in choosing the free length and diameter, but must resort to a formula or tables in order to obtain a spring that will give the desired results and not be overstrained.

Evolution of Planing Machines

By J. Richards

A brief sketch of the early designs in planing machines and the more important improvements.

A suggested form of planing machine, developed on the floor-plate principle, to make it a truly universal machine.

The caption above will indicate history, or a recountal of facts; but this is not at all the theme in mind.

History of an art is interesting, suggestive and, in some degree, useful—but does not reach that prosaic and utilitarian question, "What is there in it?" That must be the talismanic title and query set over the "goods," in these degenerate times and in this view it is more hopeful to seek for logical and generic features of an art than who first practised it and when and where.

To us older participants in machine-tool making, what Bodmer, Roberts, Clement, Whitworth, Sellers and Wilmarth have done, early in this century or before its middle, is a matter of interest, because of a feeling of association, but this is a matter of little concern now to those in the "fray." They care but little about it, and perhaps should not, if they can—as is hoped and believed—raise their efforts above the contrive, "cut and try" system, that places their methods far behind many other arts of the time.

Standardizing Shop Processes

When metal finishing demanded true flat and curved surfaces, or planing, turning and boring and modifications of these operations, we may well wonder that mechanics did not sooner reduce these to orderly machine processes. But there were several impediments: there was not much need of exact surfaces, not much cast iron or other soft or friable metal to cut and there was also a skill in handcutting with chisels, files and other tools that we can scarce conceive of at this day.

A Scotch mechanic informed me, within the year, that the men in certain shops in his country, in finishing the edges of looms and other frames for textile machinery, were, by preference of the men, working by the piece, chipped by templets and filed smooth. I have seen, in a Jersey shop, some years ago, an old English latheman, who had a contract to finish pulleys 3 inches by 8 inches to 4 inches by 16 inches, fasten his slide rest and get out his hand tools, including the old button form, and gain a third or more in time and produce better work. I have also seen many other things of the kind, that it is not safe to describe, for fear the modern concept of automatic finishing processes would be strained beyond credence.

Lack of Suggestive Precedents

There was also, at the beginning of machine-tool making, a want of suggestive precedents, only wood cutting and this nearly no precedent at all, because of its different conditions. There was no limit of speed, no pressure required and no heat generated, to speak of, and the further impediment that, while General Bentham had, in England, invented and made all the principal machines for cutting and finishing wood, these were mainly locked up in prisons and dockyards, and inaccessible to the public, down to the middle of the century.

Early experiments in turning and planing iron disclosed the great amount of power and rigidity for guidance required for a small section removed, also the high degree of heat developed by the cutting action, confining the movement to ten or fifteen feet a minute; also the strength of framing required to resist and direct the cutting edges; little wonder these things discouraged the original makers of machine tools!

Not one of these conditions could be, with any certainty, foretold, measured or even compared, because of what may be called "tool stress," that depended upon such widely varying conditions that even experiments furnished but little data. The displacement in turning and planing even in coarse work, or "cutting down," did not, at first—we may assume—exceed a section of a square centimeter, and was in great contrast to the performance with modern tools and machines.

In England, recently, a forged steel shaft 16.5 feet long, weighing about 5000 pounds, was turned all over, to accurate dimensions, in sixteen hours, moving with a surface speed of 50 feet a minute. The cuts were of ⅛-inch pitch, ¼ to ½ an inch deep, and in all this work the tools, made of a peculiar steel, were only *ground once.*

Planing Operations

For several reasons, the process of making true planes or flat surfaces has been the most difficult one of all, though not the most extensive, because the ruling forms in metal finishing are all cylindrical, produced mainly by continuous action, or wholly so, if we include "milling."

The original concept of the process, exemplified by the machine of Roberts—perhaps the first organized one for the general production of plane surfaces—did not come from analogy. There was no precedent, as may be indicated by the arrangement. First, as the cutting action had to be in straight lines. (This meant reciprocal movement and wasted back stroke.) The material, which had not, in itself, the rigidity to sustain the cutting force, without distortion, had to be attached to an inflexible platen, or table, for support. The tools and their supports could not be traversed without expensive and extensive mechanism and be movable in respect to the driving power—an insuperable impediment at that time—hence the platen and its load, with weight enough for guidance in a vertical plane, were moved forward and back by the common device of a revolving drum and a chain, winding right and left. Vertical guidance of the material was secured by gravity and the necessary weight of the platen moving on plain V ways. The tools had to be supported from a base frame beneath, and at varying hights above it, by a structure passing wholly around the work, with a great "overhang" and consequent instability. This structure had,moreover, to sustain mechanism for traversing, raising and lowering the tools, and as the work grew larger and the strains greater, the overhang increased and was weaker proportionately, while the reciprocal motion nearly doubled the length of the machines in proportion to the cutting range.

"How unphilosophical the whole scheme," one would say!

These general features have remained, to this day in common metal-planing machines; but the constructive methods and details have gone through many changes and improvements. The sliding, inflexible platen remains; the winding chains have been replaced by rack, pinion and screws; but even the chain is found in a very recent example in England, notably in Matthewson's patent 1910.

The fundamental features are proved essential, by survival, although involving certain inherent impediments, that have

made planing machines the least satisfactory in design among all the classes of machine tools.

Other impediments are the movement of heavy weights to attain cutting movement, and the double space required and loss of floor room; but we may be assured that there are certain fundamental reasons at the bottom, whether we are able to detect them or not. There is always a sound reason at the bottom of any feature of design that endures.

Fundamental Mechanisms

At this time there is a persistent effort to increase the speed in planing by accelerating the motion of the platens, on both the cutting and return movements, the former because of improvements in tools that will withstand heat and wear but without any scientific basis to start on.

To arrest, reverse and control forces such as exist in operating planing platens, one must first know just what these forces are, and until then no amount of sporadic scheming is likely to accomplish much, and much knowledge is also required in intelligent comment on the subject.

The forces are not obscure. An air piston and indicator would disclose the strains in an accurate and simple manner and may have been employed to demonstrate; but, aside from this, such forces and strains can be computed with much exactness mathematically.

In reversing planing machines, from the first, friction and "slip" has been the method; usually by leather opposed to polished metal surfaces; this expedient has been the general manner of creating such resistance and is perhaps the best that ever can be contrived.

The function of this frictional contrivance is complete, except loss of power by "slip." There is no "clutch" or positive engagement to endanger gearing; the tractive force is cumulative and the pressure required is inversely as the speed.

The objections are that pressure is produced by tension of the bands, consequently is not definite or controllable; the amount of leather is commonly ten times what is required, and is more subject to wear than other parts; shifting demands a lot of objectionable details, such as motion rods, tappets, bell-cranks, etc.

Logically, the leather tractive faces should be double, both sides acting, and the pressure controllable, the metal faces polished, not radial, but sufficiently oblique to maintain a tendency to concentricity and a means of cumulative pressure set in motion by electric or magnetic devices to substitute the present shifting apparatus. This is as far as one can go without diagrams of forces.

"Slipping" is the main point—not clutches in the common sense of engagement, which is not needed. The tool setting or "feed" should derive motion from some part of the platen-moving gearing where the speed is suitable. In speaking of the evolution of planing machinery during the time of what we may call the first period, down to the time of Whitworth, changes were not many, until he added the crank-shaping machines, reversing tool support and screw motion for traversing; but the most notable improvement, in which he was a chief factor, was in workmanship, accurate fitting of machines and precision of their product.

American Developments

Except the quick-return motion of the marvelously designed shaping machines, yet made in the Whitworth form, the art of planing remained much as at first, in all elementary features, down to about 1860, when the subject was taken up in this country and the changes of detail and improvements so centered around the works of William Sellers & Co., at Philadelphia, that one is forced to describe it as "national."

First, it must be remarked that changes made can be considered as a work of refinement of design, retaining the main original elementary features we have been describing, but clothing them in a new and logical mechanism, the product of high skill and analytical methods.

The American inventors began at the main point—the reversing gearing—and, understanding that belts can be shifted at a speed in direct proportion to their lineal speed and that their width is inversely to their speed, these were moved at double their former speed and reduced in width to one-half. Two were employed, instead of one to halve their shifting range, and a very ingenious shifting mechanism was devised, that moved the two bands differentially, instead of the old English plan of one wide band that had to be shifted two widths over an idle pulley in the middle. This was not only a change, but a revolution, that has remained ever since and been imitated everywhere.

They contrived a new kind of platen-moving gearing by a rack and screw pinion, half worm and half spur gearing, it may be called, that gave a smooth positive movement to the platens and became a monopoly, because of the patents and the special tools required for its production. The Sellers Company further removed the tool-setting function from tappets on the platen and actuated this from the main gearing of the machine—in short, refined and modified the operative action of planing machines throughout—not, as may be inferred, by scheming after things merely novel or different, but by analyzing the operative conditions and meeting such conditions by better means.

Special arrangements of planing machinery for particular uses have not developed anything in the elementary features of the process except a tolerably wide application of moving the cutting tools instead of the material and this brings up a circumstance of 20 years ago.

An Early Special Machine

I required some long pieces to be planed accurately and, not having the room or the money for a gravity platen machine of so large a size, made a special one 32 feet long to plane 29 feet with a traversing saddle and overhung tools with a reach of 3 feet, also a smaller machine with overhang of 20 inches.

There was the universal verdict that such a machine could not work, because the tool support would "spring." When finished, $\frac{5}{8}$-inch and even $\frac{3}{4}$-inch keyways could be cut at one operation on the 20-inch machine, while the same tools could not be used in a 36-inch platen planing machine alongside. Here was a matter of profound astonishment and I asked a mathematical civil engineering friend to come and look at the case. After an experiment, he said that the large platen machine lacked rigidity, obviously, and no wonder; there was 12 inches of tool overhang in the small machine and over 60 inches in the large one. He then went over the sections and strains, direct and torsional, and we experimented with long radius bars of wood and found the deflections in the two cases about as the respective tool overhang in the two machines, or 3 to 1.

Departing from Standard Practice

Other machine tools were examined by my friend, who had no experience in practical metal working, and the result was to point out a new method of design suggested in the present article. The overhang machines became a standard type and more than two thousand are now in use.

To pursue the subject of planing, there is in this and other cases the difficulty of avoiding criticisms on current practice, which it is the desire to avoid whenever possible, because there is no purpose to be served.

The shifting of planing-machine design from Europe to America was not without failures, or, in other terms, losses by tentative designs and going too far—as was to be expected, because of the "cut and try rule of thumb" method was almost universal, not only in this, but throughout other countries.

Accomplishing Work Positively

A change of personal business, years later, brought me into contact with another branch of engineering work and in contact with the staff of a large works where there were found several young men who were not makers of machines, pumps, engines, nor of anything else, for that matter. They were what we may call critics and computers, armed with various instruments and a schooling in

mathematics, physics and correlated science.

In the works referred to, empirical knowledge and skill—or experience—had the principal place, as it must have for a long time to come; but the "analytical staff" kept moving things toward a scientific basis, more and more, and frequently found itself in contact with tool problems.

A case will illustrate. The "staff" had to do with a special machine acting by reciprocating motion and the problem was to actuate the tool "feed." Movable tappets on the table were rejected as too positive and too sudden. The friction quadrant driven from the second shaft in the platen gearing; the Sellers form of positive operation from the same shaft, and the Bement loose segment wheel driven in the same manner, all passed in review.

The time and place of setting the tools were affected by the range or acting arc of crank, also whether at the end or beginning of the stroke.

When all the operative functions of the machine and of the feeding devices were ascertained, the job was done—no contriving, trying or guessing by the "auxiliary staff."

Fundamentals of Processes

Planing, construed broadly as removing surplus metal and leaving flat surfaces, comprises various processes such as cutting, milling, grinding, rotary facing and abrading. The choice between these processes is commonly determined at once by precedent and the particular conditions that exist, but sometimes these are not clear. Just now may be noticed a reversion in this country to rotary grinding in a horizontal plane, even to remove roughly surplus metal.

As a rule, for all friable substances, including cast iron, the coarser the chips the more rapid the process; this is exemplified by stonecutting machinery or hand tools.

Grinding, being the application of thousands of cutting points of extreme hardness constantly renewed by wear and substitution, has for centuries been a means of cutting and removing surplus hard material; but it involves the pulverizing of waste material and consequent loss of power, with other objections that give little promise of success in planing flat surfaces.

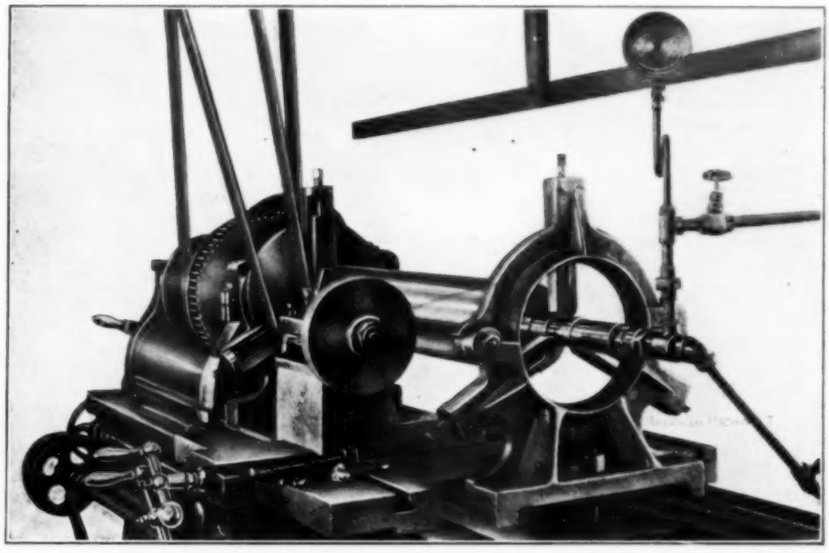
Planing has been called the most difficult and unsatisfactory of cold processes in machine tools. This is proved by the continuous efforts made to avoid and substitute it. Such efforts are continually going on and are largely successful. To attain continuous tool action, because the large size and cost of such machines and the room required furnish strong reasons for these attempts.

An ideal planing machine for metal would be a large slotted floor plate, to which all kinds of pieces could be fastened to give stability to the work; above this and parallel to it, another plate of equal or greater size and on its nether face all kinds of auto-acting tools, circular as far as possible, to operate in all planes and angles supported from the top.

Grinding Rolls under Steam Pressure

The illustration shows how the rolls for textile machines are ground so as to be true in actual operation. These drums are made of heavy piping having the heads forced into place and when in use are heated by steam to the required temperature.

Knowing that this heating distorts the roll to some extent, the Curtis & Marble Company, Worcester, Mass., turn and grind these rolls under the same steam pressure at which they are run in service. This shows how the steam is admitted to the roll through the bearings at the end, the steam gage and all the connections.



Grinding Rolls under Steam Pressure

Preventing Accidents with Grinding Wheels

We are very apt to take it for granted that, because a device has been on the market for some time, everyone knows all about it and that instructions are superfluous. We overlook the fact that some absorb information only by seeing and that they have all too often, never seen the device used in the right way. Then too there is a new lot of boys and men coming into the field every day who must be taught in the easiest and quickest way possible.

The use of grinding wheels can hardly be called new, and yet there is such a lack of knowledge regarding the proper method of mounting and using them that the Norton Company has just issued a very neat little booklet which contains much useful information which should be known by every user of wheels and gives many suggestions which will be extremely valuable to those who are interested in the prevention of accidents in shops. The booklet is entitled "Safety as Applied to Grinding Wheels."

This calls attention to the importance of mounting wheels properly, on proper-sized spindles, about 0.005 inch smaller than the bushing to allow the wheel to go on without forcing and yet not be loose enough to allow shake or untrue running.

It points out that, as a man with a two-foot wrench can exert a pressure between a pair of 8-inch flanges of over a ton and a half, it is very important that flanges should only be tightened enough to hold the wheel firmly and without undue strain. Simple and effective wheel guards; glass shields for protecting the workmen's eyes where fine work is being ground; a substitute in the shape of a leather spark brush; goggles and exhaust systems are shown with illustrations, attention being called to the fact that dust not only injures the men but adds to the wear and tear on machinery and belts.

A simple and effective device is shown for preventing wheels being run at too high speeds when old and worn wheels are replaced by new and larger wheels. Other equally valuable suggestions are given regarding the care of wheels and machines and assistance is requested in making a more complete book which is under way, of the utmost value to users of grinding wheels.

Small steel castings have been jocularly defined as "a network of holes surrounded by unmachinable metal."

Machining Transmission Gears

Editorial Correspondence

An every-day job on the new 3 x 36-inch Jones & Lamson flat-turret lathe.

These bevel gears, 11 inches diameter, of drop-forged 0.20 carbon steel, are machined on four faces to very close limits at the rate of 80 in 9½ hours.

The Brown-Lipe-Chapin Company, Syracuse, N. Y., is machining the bevel gear shown in the line cut, Fig. 1, in what is probably the fastest time that has ever been made on this job. I would call attention to the very close limits on this work, which is done on the Jones & Lamson 3x36-inch flat turret lathe. The blanks are drop forgings, about 0.20 carbon steel and are not forged close to size, the rough blank weighing 20 pounds, while the finished turned blank ready for cutting the teeth weighs 15 pounds.

I am unable to show the first operation, but Fig. 2 shows a similar operation on a different gear handled in practically the same manner.

First Operation

The rough blank is gripped in a three-jaw chuck, the jaws of which are recessed so as to draw the blank solid against the inner steps of the jaws. The first operation is to rough-bore. This tool cuts at the back of the hole and is consequently held cutting edge down.

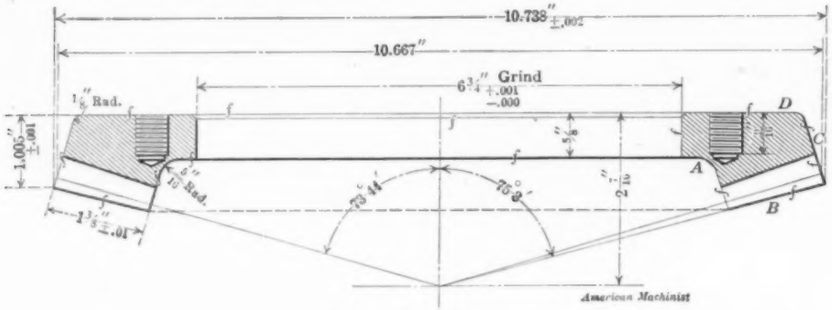


Fig. 1. The Gear

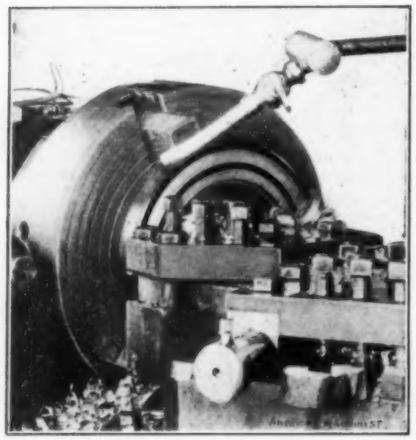


Fig. 2. Roughing the Backs of the Blanks

Two tools are used for rough facing. They are held in the front. As soon as the boring tool has passed through, one rough-facing tool starts at the center of the face and the other starts at the front side of the hole, the back-facing tool is also held on the front side. The cross feed to the head is then thrown in, feeding from front to back. Having the two rough-facing tools thus spaced cuts the time in half, besides the front faced in this operation is about twice the length of the part machined by the back-facing tool. In Fig. 2 are shown two black rings, one between the two rough-finished parts of the face, the other at the outside. The time on this job is 50 in 10 hours, the cutting speed 160 feet, and the steel used for tools Novo Superior, hardened in brine. In the first operation about 2½ pounds of chips are removed.

Second and Final Operation

For roughing and finishing the face the gear is chucked by the bore on a hardened and ground disk, and is held in place by a heavy washer *B* and winged nut *A*, shown best in Fig. 6. The washer is provided with openings so that it can be slipped over the nut and removed when changing the work. This method of holding was devised by James Hartness and has been in constant use on the 3x36-inch Jones & Lamson machines for the past 10 months. The ring having been chucked, a tool ground to the proper angle is fed straight in (as shown in Fig. 3), till it meets the radius left by the finishing back tool in the previous operation, the bed stop has, of course, been set to regulate the depth of cut; meanwhile, the back-angle roughing tool, held in the angular slide *B* (on top of the head) begins its cut. The turret is then indexed and

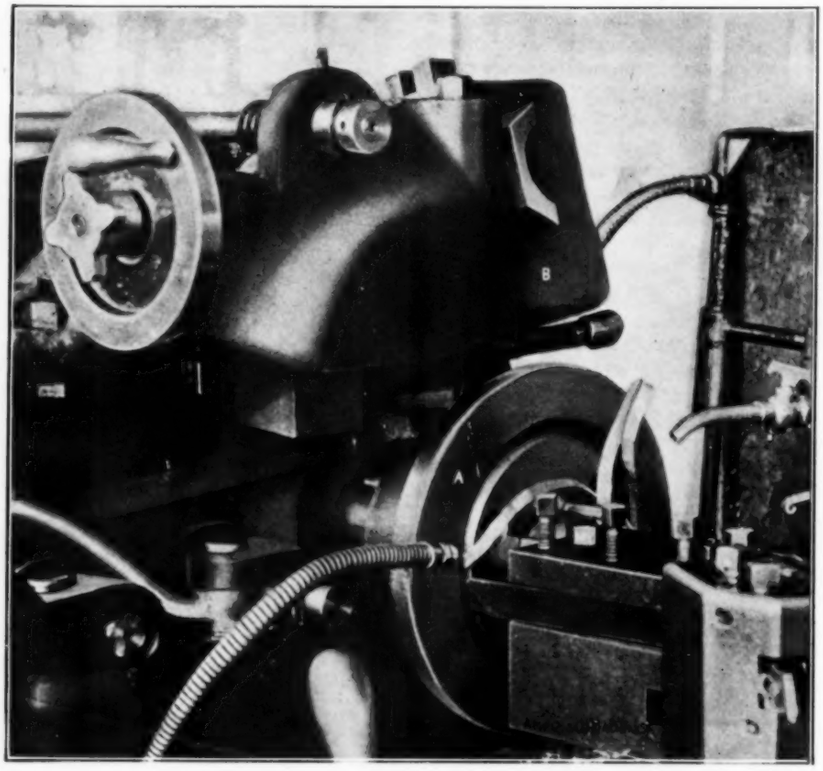


Fig. 3. Machining Inside and Back Angles

the double rough-facing tools presented, one at the back and one at the front of the carriage.

By referring to Fig. 6 the construction of the essential points of the new head

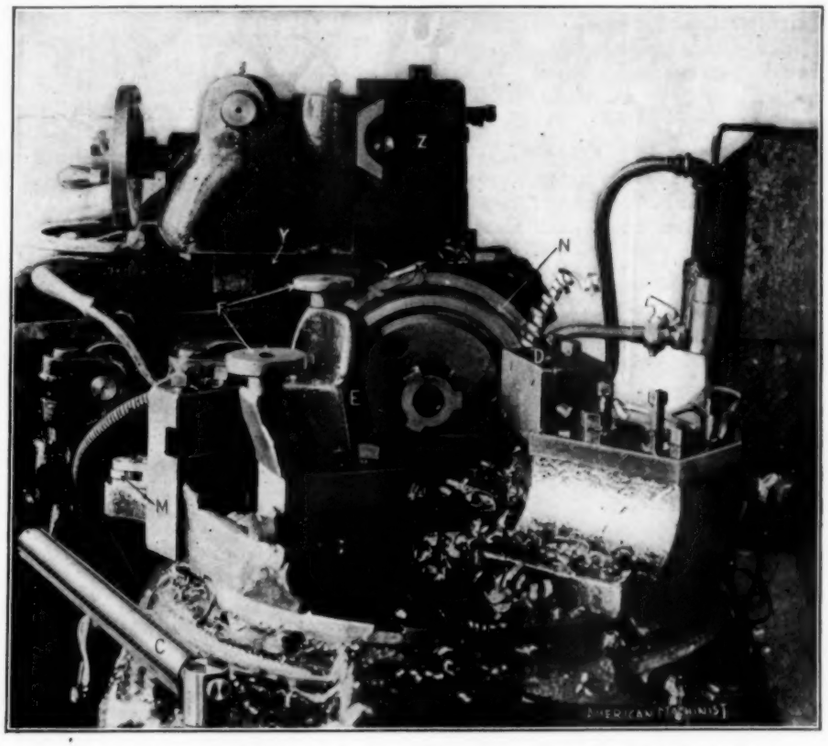


FIG. 4. ROUGHING FACE WITH TWO TOOLS AND FINISHING BACK ANGLE

can be readily understood. *Z* is the angular slide, which is adjustable anywhere from vertical to horizontal, and is clamped by the binder screw *L*.

Y is a former, which engages a roller held in the tool block at the front, and *X* an adjustable former engaging with another roller at the back of the turret. These formers are so located that as the head traverses across the bed, the tools follow the desired path across the face of the gear.

In Fig. 4, at *F*, are shown two of the rollers, which engage with the former *Y*, and at *M* is shown the roller which engages with the former at the back of the head, shown in Fig. 6 at *X*.

The locking bolt of the turret is withdrawn, so that the turret can swing to the formers. The carriage is clamped by the lock bolt *C*, Fig. 4. The cross feed to the head is thrown in, working away from the operator. The back angle slide *Z*, Fig. 6, travels with the head. The former, engaging with the roller on the back of the turret, swings the turret and tools so that they cut the desired angle on the face, the front former being adjustable for any angle of face.

The roughing tool *D*, Fig. 4, starts at the outside of the rim at the back and the roughing tool *E* starts in the inside of the rim at the front. The black circle *N*, Fig. 4, shows the uncut portion of the gear just previous to the two cuts meeting in the center of the face of the gear. This method of roughing the face cuts the time in two. Meanwhile the roughing back-angle tool on the top, which is timed to complete its cut as the two front cuts meet, has completed its cut. The finishing back-angle tool held in the same block starts its cut without loss of time. The roughing speed is 160 feet per minute.

The turret is again indexed and the finish face-angle tool presented. The carriage is run up to bed stop and set so that the former roller at the back is in contact with the back former *X*, Fig. 6. The back roller and former are provided with spring tension. The cross feed for the head is again thrown in, away from the operator, and the speed changed to over 500 feet per minute (the cut meter registered up to 500 feet only). The finishing tool *J*, Fig. 5, taking a cut about 1/64 inch deep, traverses and finishes the face. At the same time the back-angle tool finishes the back angle and a radius tool chamfers the back edge of the gear.

The faces *A*, *B*, *C* and *D*, Fig. 1, show the work done in this second operation at the rate of 80 gears in 9½ hours.

The top slide *Z*, Fig. 6, is driven from the pulley on the rear end of the spindle-drive shaft.

A is the winged nut and *B* the washer provided with slots so that it can be slipped over the winged nut. The holes are for finger holes.

For the information on this very interesting work we are indebted to W. W. Washburn, who has charge of the Jones & Lamson flat-turret lathes, on which it was done.

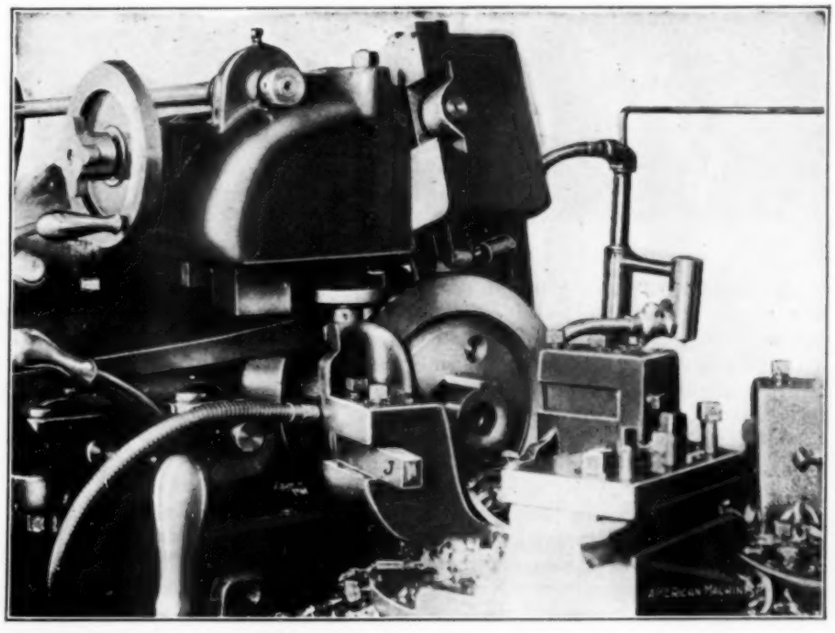


FIG. 5. FINISH TURNING THE GEAR AT A SPEED OF OVER 500 FEET PER MINUTE

One of the signs of increasing general activity in and recognition of aviation, is the erection by the National Cash Register Company, at Dayton, Ohio, of a fine building—hangar to be more exact—for housing aëroplanes, close to a favorable field for getting into the air. Numerous flights are to be made at the Wright Brothers' aviation field by men being trained for flying. These include well known citizens and officers of the army and navy.

Items that Affect Depreciation

By Robert Grimshaw

This is one of the items that give trouble in making an inventory, for the simple reasons that there are hardly any two classes of articles about the establishment that suffer the same percentage of depreciation, and hardly any two establishments in which the rate would be the same for any one class. Further, some things, instead of depreciating, increase in value.

However, while we cannot lay down any hard and fast percentages, we can at least fix upon some general principles that will serve as guides in calculating the depreciation, or the increase in value.

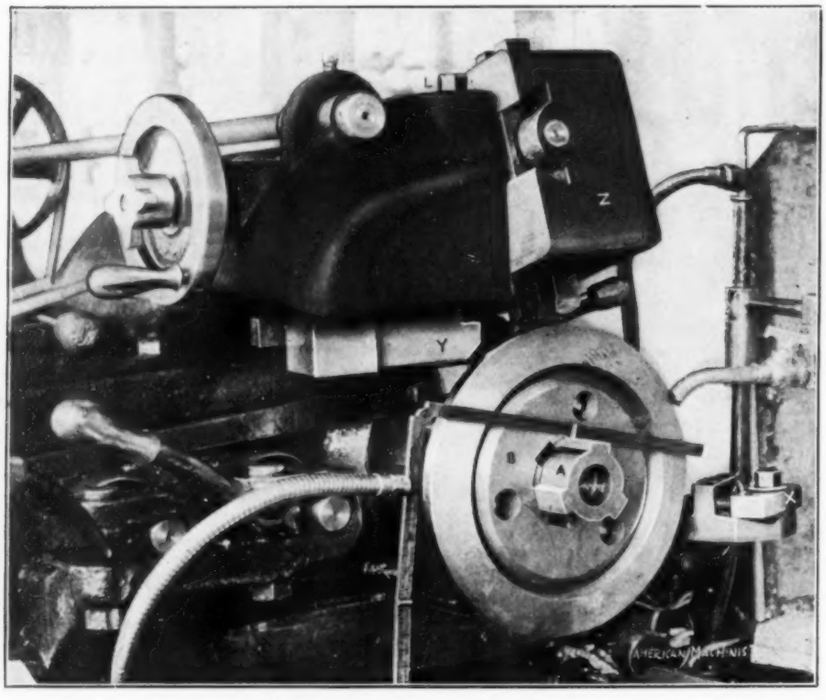


Fig. 6. The Finished Gear

The causes of lessening in value, or, at any rate, market value, can be classified as follows:

Breakage by reason of defect of construction, or of faulty material. But even this cannot be considered as a lessening in worth, if there is an unexpired guarantee on the part of the builder or dealer who furnished the machine in question.

Carelessness or malice on the part of the workmen. In this case, if there is any redress that will enable a compulsory replacement or repair, the depreciation may be considered as less.

Changes in process, as where planing has been replaced by milling; or planing and milling by grinding, in general practice; in which case, it may be that a new machine of one type will be less salable than an old one of another. Further, where special machines have been made, which are not available in other establishments, and more especially where they are intended to carry out patented processes and deliver patented articles; in which case they may hardly be classed as valuable. In any case, the rate of depreciation of such machines is more rapid than that of other machines in the same establishment; particularly, if the articles which they manufacture are to be replaced by newer types. This occurs very often in automobile manufacture.

Change of custom or taste. For instance, if the fashion in furniture were to change from fluted legs to turned ones, fluting machines would have much less value.

Expiration of patents. This may or may not cause a depreciation of value. If the firm controlling a patent secures a better one and has no objection to its rivals' making the old type, the old machines are salable as machines; otherwise they have only scrap value. The same may be said of secret processes.

Panics. If there is a prospect of a panic that will last a couple of years, the depreciation of all machinery is greater than if business is likely to be good.

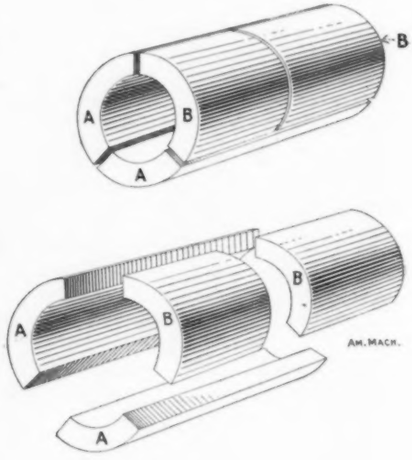
Fire, explosion, damage by water, etc. These cause depreciation, but this may be covered or more than covered by insurance.

General running down. In other words, old age. This applies to many types of machines, especially those running at high speed, which in consequence of long continued use, although with great care, can no longer run at such a high rate. Circular saws diminish in diameter and cutting power; re-cut files, as a rule, do less work than new ones.

Bearings for Grinding Rolls on Their Own Journals

In the Waterbury Farrel Foundry and Machine Company's shops they have a very clever way of making the bearings used in the grinders for grinding rolls on their own journals.

A cylindrical cast-iron bushing is bored and turned at the one chucking, it is then sawed lengthwise into three 120-degree pieces, as shown in the line cut. One of these pieces is cut in half in the middle. The pieces *A* support the weight



The Bearings

of the roll in the grinder, one being placed under each journal. The short pieces *B* are used as caps, and having no weight to support they have ample area for this purpose.

Valves and small fittings made of iron well galvanized on the exterior may be homogeneously covered with lead in the workshop by any mechanic. The method consists, according to the *Chemcial Trades Journal*, in immersing the piece to be coated in water to which a few drops of sulphuric acid have been added. Then, while in the acid water, the piece is readily amalgamated in the usual way by squeezing mercury through close-woven cloth all over its surface and thoroughly rubbing it in. The excess mercury is rubbed off and the piece carefully dried without heat, and then immersed in a bath of lead, which should be well above its melting point, so that it would not tend to solidify by introduction of the cold piece. The casting may be withdrawn after about 20 seconds, and will be found to be homogeneously covered with lead. This method requires the piece to be galvanized before applying the lead, and the galvanizing must be in good condition, otherwise the subsequent amalgamation will be imperfect and present an unsightly appearance.

Hindley Worms, Hobs and Gears

By M. E. Hoag

Special fixtures and methods used at Rock Island arsenal in making Hindley worms, hobs and gears that insure ease of operation and freedom from backlash.

Some very interesting special fixtures and machining operations are used in connection with the making of Hindley worms, hobs and gears at the Rock Island Arsenal, Rock Island, Illinois. The worms and worm gears described herein are used in the elevating devices on 3-inch, 4.7-inch and 6-inch howitzer gun carriages.

In Fig. 1 are shown a hob *A*, worm *B* and elevating arc, or worm gear *C*. The reader will note the cross lines *D* on the hob as reference will be made to them later.

Fig. 2 is a sketch of the worm and hob turning and threading device.

Fig. 3, taken from the rear of the machine, gives a good idea of the construction of the tool-holder slide, the worm for driving the fixture, and the extension

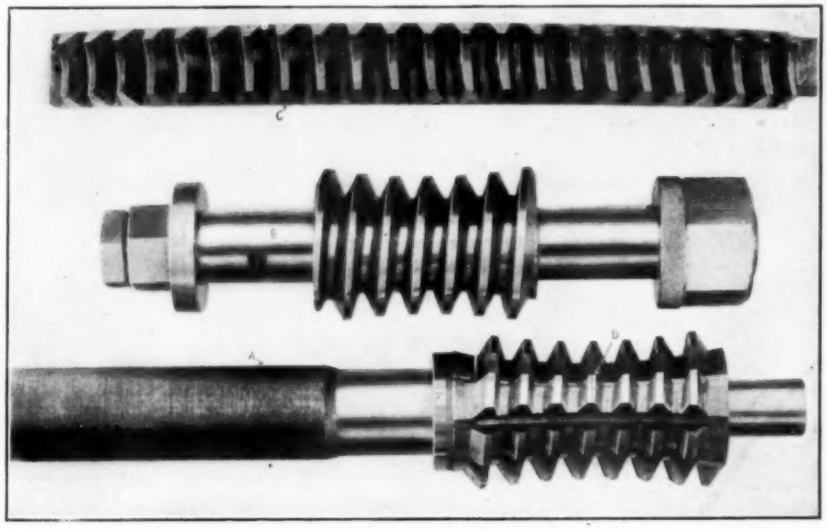


FIG. 1. HOB A, WORM B, AND WORM GEAR C

centers for the lathe. At *B* is seen the special dog for holding the worm *C*, which is driven by the slot *A*, in the headstock extension. Fig. 4 is another view from the rear of the lathe, with the worm dogged and in position between centers.

Fig. 5, taken from the front of the lathe, is a side view of the tool slide and feed screw, together with the method of driving the fixture through the gears *A*, shaft *B*, bevel gears *C*, and worm *D*.

Figs. 6 and 7 show a special fixture applied to a Gould & Eberhardt gear-hobbing machine, with an elevating arc in position ready to hob.

Some of the worms and arcs were tested after they had been placed in the gun carriages, and, judging from the ease with which they were operated and the freedom from back-lash, the results obtained with these attachments are about all that could be desired.

MAKING THE WORMS

The worm blank is first rough-turned all over; stock is left at each end of the threaded part to be turned off after threading. This is done in order to prevent the error that might be caused by the spring of the tool on entering and leaving the cut.

After roughing, the piece is placed between centers in the lathe as shown in Figs. 4 and 5, and the radius finished. The proper diameter, and the location of the smallest part of the worm is determined by the use of double ball-pointed micrometers. A line is now struck around the piece at the *exact centers* of the radii. This requires considerable care as it is used in locating for other measurements.

The thread is now cut; the teeth are given the same depth as those in the hob, but the width between the teeth is slightly narrower, which gives top and bottom clearance. The diameter of the worm at the pitchline is determined by the use of three wires and the micrometer. After threading, the threaded part is faced off to proper length, measuring from the center line and the bearing ends are finished.

MAKING THE HOB

In making the hob the same fixtures are used as in making the worm, and the operations are very similar.

In roughing out, stock is left at each end of the threaded part equal to not less than one-half of the pitch, as the end teeth of the hob must be *equally distant* from the center line, and have *full cutting surfaces.* The roughed blank is now placed between centers of the lathe, with the center of the fixture pivot *A*, Fig. 2, exactly in the center of the hob radius. The radius is finished and the center line struck, just as in making the worm.

In threading the hob, proper width and depth of tooth are obtained by the use of a templet gage, and the wires and micrometer. After threading, a second line is struck, parallel with the hob axis and

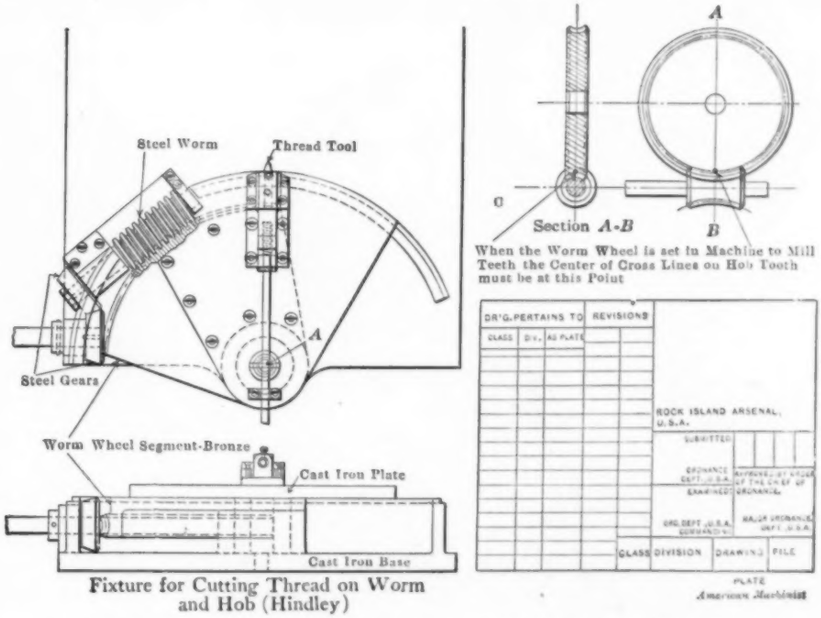


FIG. 2. THE WORM- AND HOB-TURNING AND THREADING DEVICE

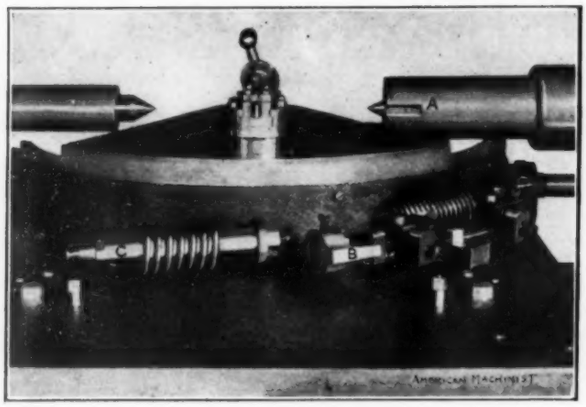


FIG. 3. REAR VIEW OF THE WORK

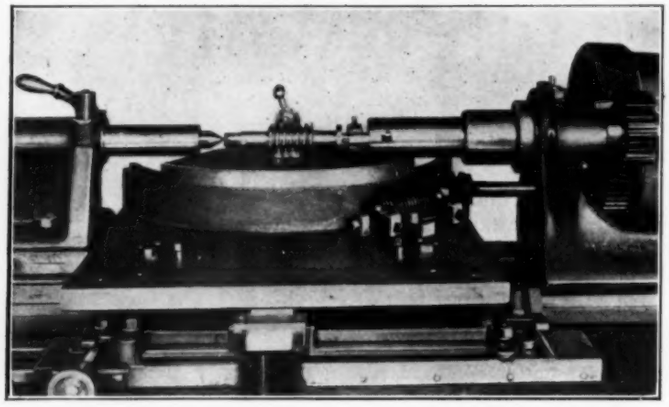


FIG. 4. REAR VIEW WITH THE WORM DOGGED AND IN POSITION

crossing the first line exactly in the center of the top of the tooth.

In milling the flutes, care is taken to make the cut deep enough to give a good cutting surface at the bottom, as the face of the gear is sized by the hob. The teeth of the hob are backed off either with a file, or in the lathe, by increasing the lead for one side and decreasing it for the other side. By this method, however, it is necessary to reset the tool for each tooth. After threading the ends are faced off. The bearings are turned, leaving 0.015 inch for grinding. After hardening, the hob is recentered and the bearings ground to size.

TURNING AND HOBBING THE ELEVATING ARCS

In turning up, the outside diameter of the arcs is left about 0.020 inch large to

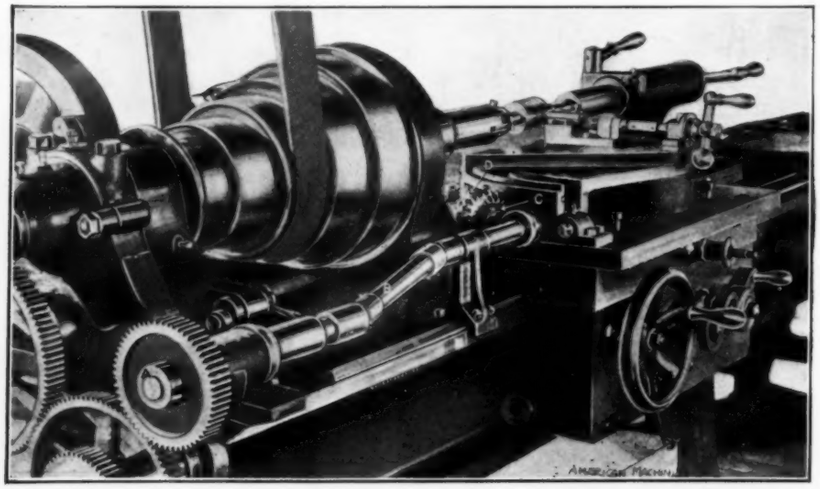
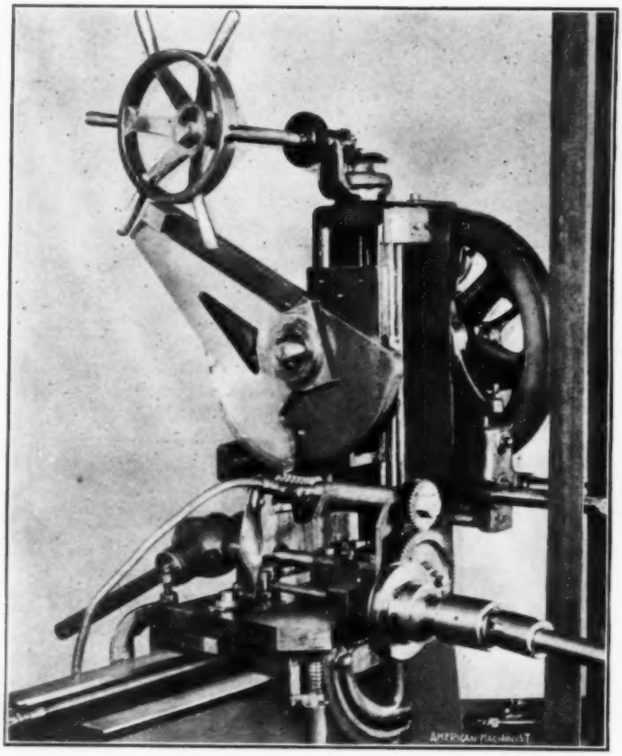
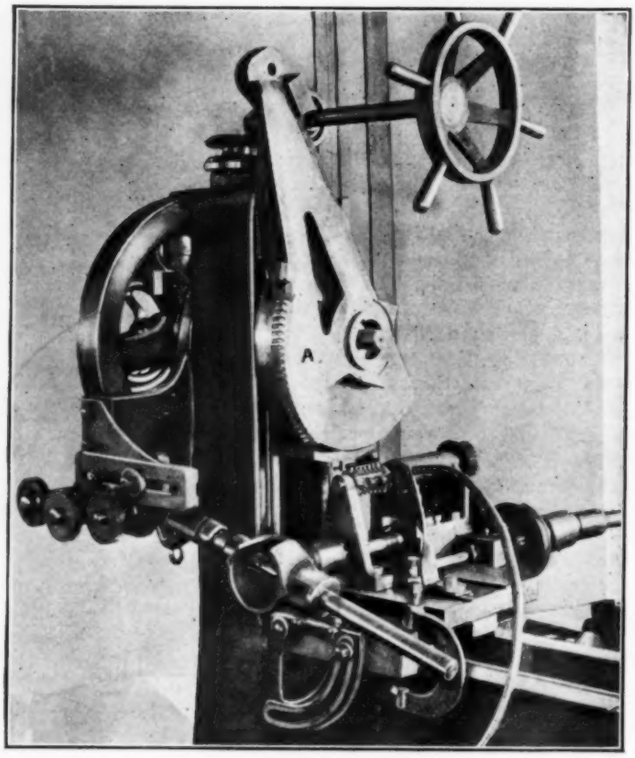


FIG. 5. A VIEW OF THE WORK FROM THE FRONT OF THE LATHE





FIGS. 6 AND 7. AN ELEVATING ARC IN POSITION READY TO HOB

be finished by the hob. The arc is placed in the Gould & Eberhardt machine, with care to get the center of the hob axis in the center plane of the worm wheel, or arc.

When a *located* tooth is required, the hob is turned until the center of the cross lines is exactly on top, and the work in the machine is then located from this. The proper depth of tooth is obtained by measuring with ball-pointed micrometers from the center bore of the arc to the center of the radii on top of a tooth, or it may be determined by measuring at the pitch line with the micrometers and a ball of suitable diameter, either of which methods prove entirely satisfactory for determining the depth.

Building and Testing Magnetos

By Ethan Viall*

A multiple cutting tool of unusual design.

Winding armatures and the fixtures used.

Testing armature shafts and the way they are ground.

Bending double magnets.

Testing finished magnetos.

*Associate editor.

In a previous article we described the machining on some of the magneto parts made by C. F. Splitdorf, New York City, and in this article we will continue the machining operations and also describe some of the other processes.

Fig. 1 shows a vise jig used to hold armature cores while straddle milling the four edges. This is better made than the average jig of this type, the clamping jaw being made to slide in the base and has a left-hand nut in it, so that the handwheel may be turned right or left, to clamp or loosen, which is the natural movement.

A Useful Gang Tool

An unusual gang tool is shown in Fig. 2, which is used in this case for shoulder cutting on armature shafts. The body of the tool which is bolted to the cross slide carries a long dovetail over which six or seven tool holders, like *A B C*, can be placed and clamped. The tools used are made of cut-off steel, and are clamped into a slot by eccentric levers, more clearly shown in Fig. 3. From the construction shown in this halftone, it will be seen that the eccentric clamping levers may be easily removed entirely from the tool holder to facilitate the removal of the cutter. Each tool holder is securely clamped in place on the dovetail slide by means of a setscrew underneath. This construction makes a gang tool that can be easily set up for a large variety of jobs.

Winding Armatures

Armatures are wound in a lathe, Fig. 4, fitted with a special holding apparatus and a revolution counter *A*, which is so made that when the hand is half way around, the armature has a sufficient number of turns of wire wound on it. A small box *B* holds a ball of twine, which is used to tie the end of the wire on the armature until otherwise fastened after it is wound.

The way the armature is held in the lathe is clearly shown in Fig. 5, one end of the armature core being set into a fixture on the lathe faceplate, and the other end held by a block *A* on the tail center.

Armature shafts are tested for accuracy in the testing stand, shown in Fig. 6, using three test gages. The V supports for the shafts are set into a grooved base and may be adjusted for distance and the slots into which the stands for the indi-

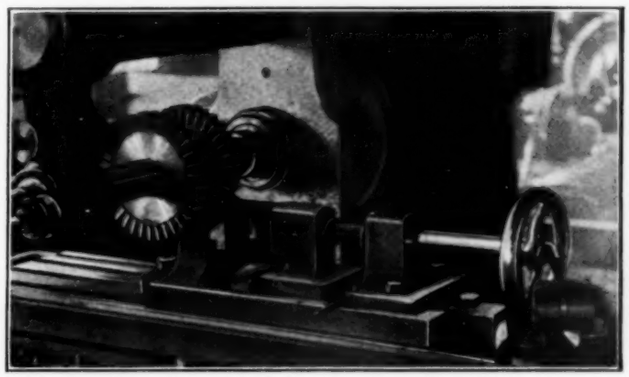


Fig. 1. Milling Edges of Armature Cores

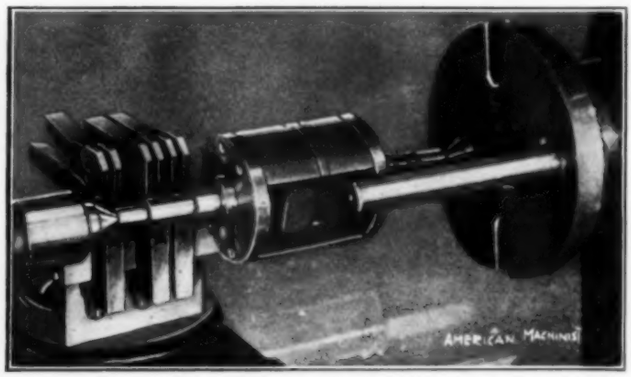


Fig. 2. Adjustable Gang Tool for Cutting to Shoulders

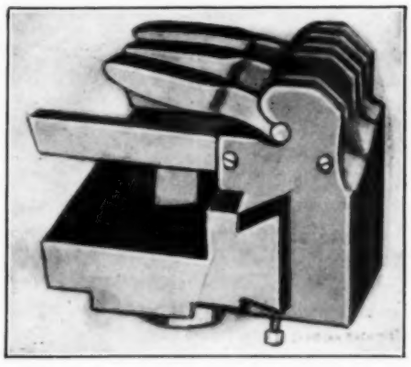


Fig. 3. Details of Gang Tool

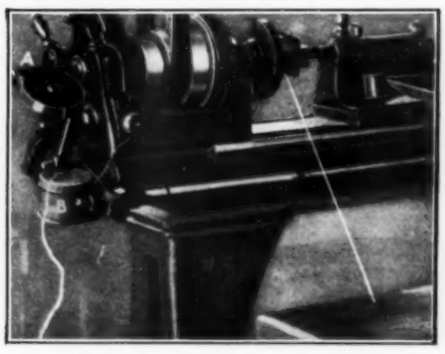


Fig. 4. Winding Armatures in Lathe

Fig. 5. Way Armatures Are Held

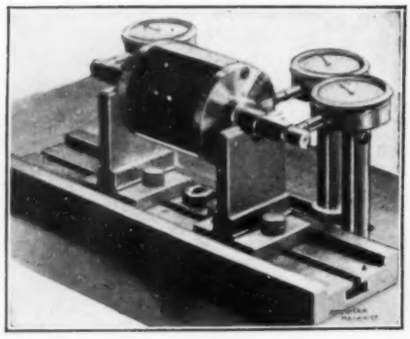


FIG. 6. TESTING ARMATURE SHAFTS

cators are set also allow considerable latitude of movement.

An interesting feature of the grinding of these armature shafts before testing is that a wide wheel is used and fed straight in, grinding the entire length of each bearing at once, with no traverse movement as at present is the more common practice.

PUNCHING KEYWAYS IN CAMS

Keyways are punched in small cams, using the fixture shown in Fig. 7, being located by a central guide pin and locked by sliding jaws operated by the hand screws. The punch is made of a thin piece of steel, the thickness of the keyway, which is set into a holder and locked by screws, and the cutting point is beveled somewhat sharply, like a chisel.

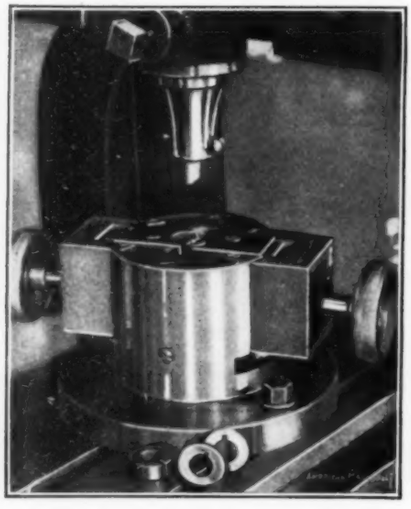


FIG. 7. PUNCHING KEYWAYS IN CAMS

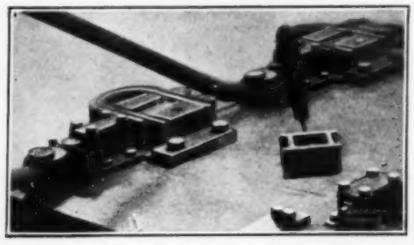


FIG. 9. SETTING CLAMPS

BENDING MAGNETS

The permanent magnets are made of two pieces of special steel, both bent at once, in a bulldozer *A*, Fig. 8, which shows two of the pieces just as they come from the dies, having been bent over a form by a U-shaped former having rollers on the corners, which do the bending. *B* is a stop which is raised on the stroke by the cam slide *C*, fastened to the bulldozer ram by the bracket *D*. As the stop rises, the pieces to be bent are clamped down by the plunger *E*, operated by the lever *F*, which carries a roller *G* running on the cam slide *H* fastened to the ram, the lever being fulcrumed at *I*, the action of the cam slide being merely to allow the weight of the roller and lever to push the plunger down sufficiently to clamp the pieces, and on the return stroke, to raise the plunger up out of the way.

The pieces to be bent are first heated to a red heat, and after forming, are clamped in the eccentric-lever clamps, Fig. 9, until set, when they are buried in lime. There are a number of other operations, such as drilling, grinding and hardening, that will not be touched upon in this article.

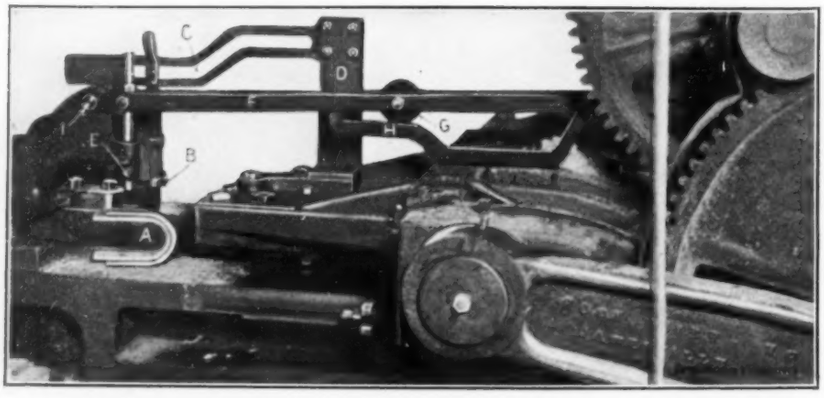


FIG. 8. BENDING MAGNETS IN BULLDOZER

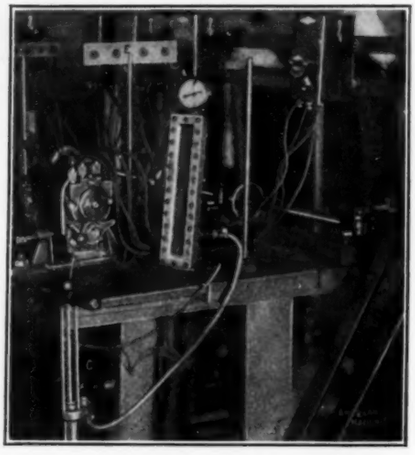


FIG. 10. TESTING WITH PLUGS UNDER PRESSURE

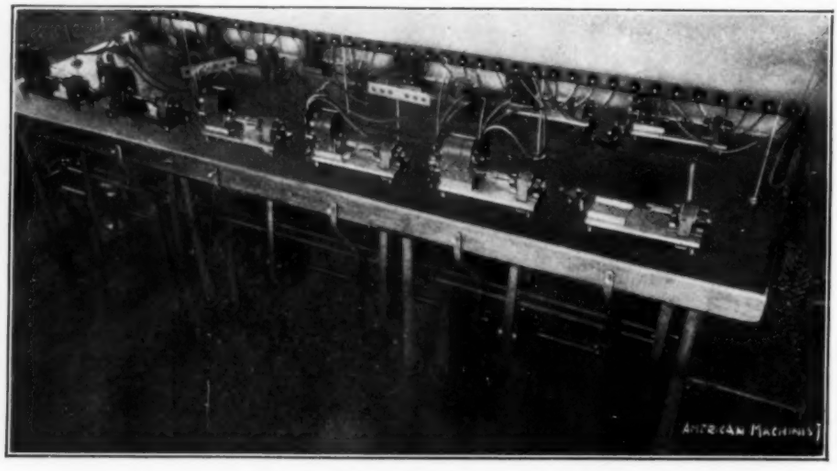


FIG. 11. MAGNETO-TESTING BENCH

MAGNETO TESTING

Fig. 10 shows a method of testing with spark plugs under pressure. *A* is the magneto; *B* a glass-front pressure box, into the back of which spark plugs may be screwed, so that a spark between their points will show through the glass plate. Pressure is supplied by means of the hand pump *C*, and the required amount is registered by the gage *D*. By using

this apparatus, tests are made with the plugs under the same pressure that they would be in actual service. Open-air tests are also made with plugs in the stand *E*.

A running test is given all magnetos before shipping, on testing tables similar to Fig. 11. On this table the magnetos are set into a special base, connected to a shaft and runs at from 1400 to 3000 revolutions per minute for three days. Then they are taken all apart, inspected, reassembled, and again given a three-hour test, which, if satisfactory, is the last.

Power Required for Drilling

By W. T. Sears *

A series of charts plotted from careful experiments to determine the torque, power and thrust required to drive standard twist drills in various materials.

*Mechanical engineer, Niles-Bement-Pond Company, Philadelphia, Penn.

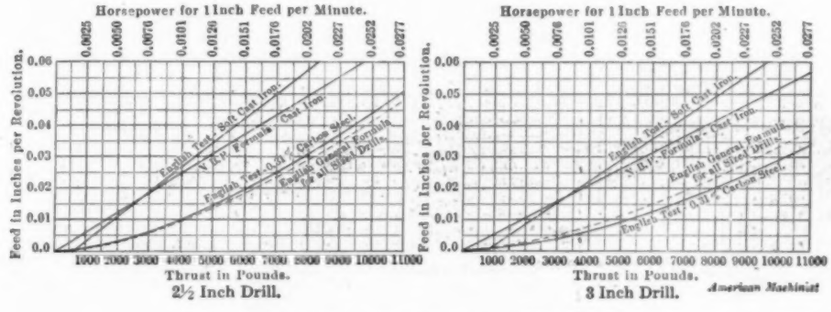
Ten charts shown herewith show the results of tests to determine the torque and thrust required for standard twist drills of 1, 1½, 2, 2½ and 3 inches diameters. They were compiled in this form as being most convenient for reference purposes and also for comparison.

Curves marked "English Tests" were laid out from the results of the experiments of Dempster Smith and R. Poliakoff, presented in a paper before the Institute of Mechanical Engineers, during the year 1909. Their tests were very thoroughly and carefully made and can undoubtedly be depended upon.

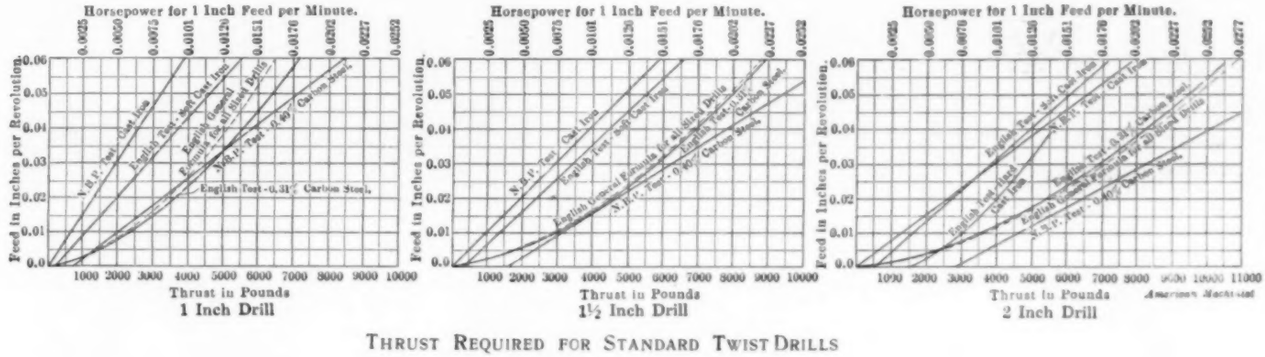
Curves shown and marked "N-B-P" tests were conducted by the engineering bureau of the Niles-Bement-Pond Company a number of years ago, and are plotted on the same charts for the purpose of comparison. It will be noticed that in most cases there is very little difference between the two and they, therefore, seem to prove each other quite well, warranting the assumption that for practical purposes they are correct.

The Niles-Bement-Pond tests were not made with the amount of refinement that was employed in the English tests, but at the same time the apparatus was fairly sensitive, and experiments were carefully conducted and a large number of them made. The chief discrepancy is in the amount of thrust required for drilling steel, but even this difference is not as great as it would seem to be judging from the chart of the 2-inch drill.

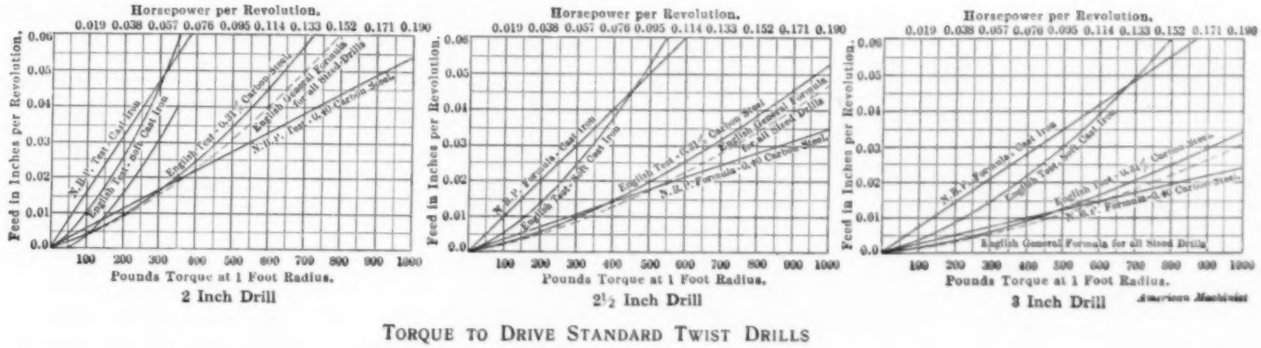
As a matter of fact the N-B-P tests for thrust in steel were run only on the 1- and 1½-inch sizes, and these tests agree very closly with the English tests. The curve on the 2-inch chart was made from a formula worked out from the smaller sizes, and in the endeavor to make this a safe one it was made too much so. The



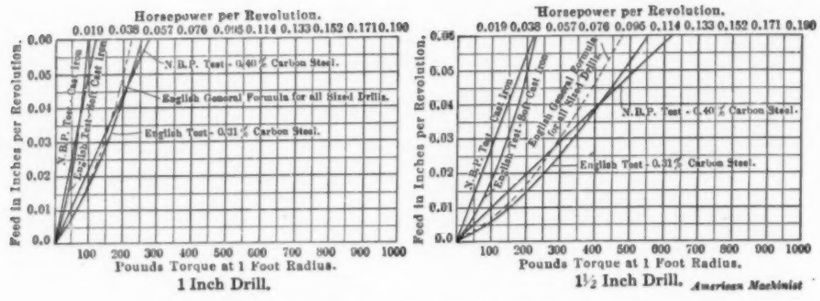
THRUST REQUIRED FOR STANDARD TWIST DRILLS



THRUST REQUIRED FOR STANDARD TWIST DRILLS



TORQUE TO DRIVE STANDARD TWIST DRILLS


Horsepower per Revolution.
0.019 0.038 0.057 0.076 0.095 0.114 0.133 0.152 0.171 0.190
Feed in Inches per Revolution.
N. B. P. Test - 0.40% Carbon Steel.
English General Formula for all Steel Drills.
English Test - 0.31% Carbon Steel.
Pounds Torque at 1 Foot Radius.
1 Inch Drill.
1½ Inch Drill.
American Machinist

TORQUE REQUIRED TO DRIVE STANDARD TWIST DRILLS

difference is still greater on the larger sizes, and for this reason they are omitted.

All drills used in the N-B-P test were kept sharp and the points ground to common machine-shop practice.

A Cock Turning and Boring Machine

EDITORIAL CORRESPONDENCE

The halftones show a special machine, built by Beaman & Smith, Providence, R. I., in use in the shops of the National Transit Company, Oil City, Penn. On this machine from 70 to 80 bodies can be bored per day.

The opposite side of the machine is shown in Fig. 2. On this side the plugs *H* are turned. They are first centered in the usual way. The end of the spindle *I* is provided with a center which centers the large end of the plug. The small end of the plug is centered also in a sort of vertical tailstock *J* clearly shown in the halftone. The plug is driven by a washer *K* fitting loosely the square on the large end. This washer is provided with lugs which engage in slots in the spindle end. The tool post *L* is of the turret type

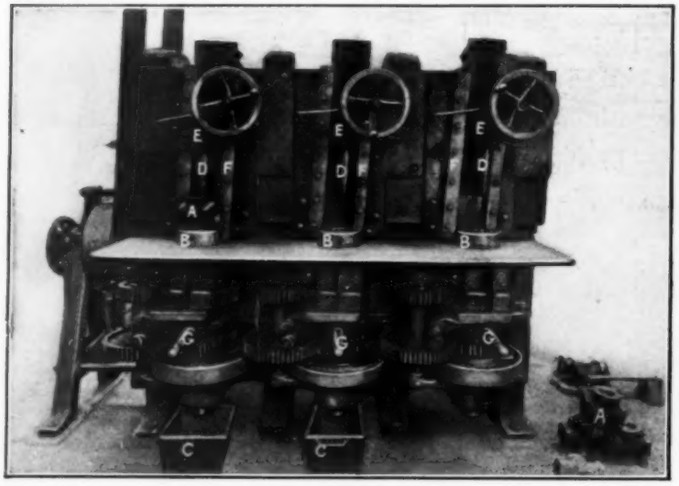


FIG. 1. BORING COCK BODIES

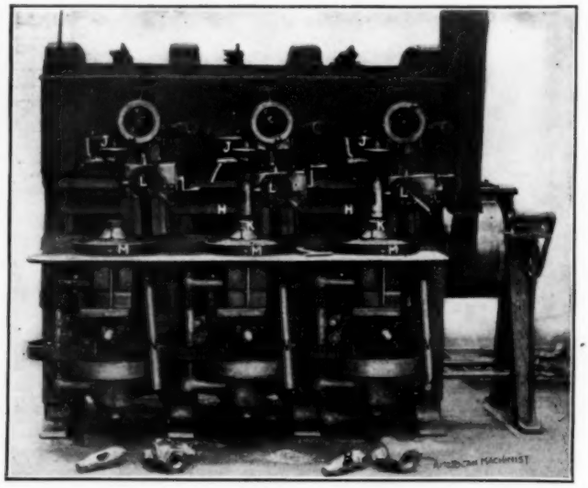


FIG. 2. TURNING COCK PLUGS

one side, shown in Fig. 1, the cast-iron bodies of the cocks *A* are bored. They measure about 3 inches diameter at the large end and are 6¼ inches deep. The body is first threaded with an external thread at the lower end. This thread fits a threaded end on the spindles *B*. The spindles are hollow so that the chips drop through to the chip boxes *C* on the floor. The boring tool *D* does not rotate. It is carried in a traversing head on the diagonal guides *F* which are set to the correct taper. To the left may be seen a cockbody *A* in place on the spindle end. Each spindle is independently driven and can be stopped at any time by throwing the clutch operated by the lever *G* below and to the front of the table. The feed to the boring bar can also be thrown out of engagement at any point. With and carries roughing and finishing tools. The spindle drives and the feeds are similar to those on the opposite side of the machine. A pan *M* surrounds each spindle end and a pipe *N* from this pan conducts the chips to chip pans on the floor. The output of this side of the machine is about the same as the other side, i.e., about 70 to 80 finished plugs per day.

Publication vs. Patents

BY EDWARD SOBOLEWSKI

Should a mechanic offer his savings for patent rights? An inventor is usually so enthusiastic about his invention that he persuades himself into believing that as soon as his patent appears in print he will have people coming to him by the score offering to buy his patent. He loses sight entirely of the fact that there are several hundred patents published every month. How sad is his awakening to find that the only answers he obtains are those of people offering to find a buyer for his patent.

As far as progress and the general welfare are concerned, it is desirable to have all the various ideas published, but this may be done without obtaining patent papers. I believe that the average inventor would do far better to send his ideas to some mechanical paper for publication or to interest some moneyed interests in his idea before he applies for the patent rights. If he has something good and can show the man with capital a reasonable profit and a good market the latter will be glad to pay all expenses.

Color Inconsistency

Ink-pads for rubber stamps are usually of four colors; violet, red, blue and black. But what maker takes care to have the enameled tin cases indicate the color of the ink? One often notices a black pad with red ink, and a red one with blue ink; while my pale-blue box contains the pad for black ink!

Color should play an important rôle in aiding classification—a fact seemingly unappreciated by the makers of ink-pads.

The world's largest crane has recently been erected at Govan, near Glasgow, on the river Clyde, for the Fairfield shipyards. The crane on slow gear can elevate 200 tons extended 75 feet along the jib, and on quick gear it can manipulate a load of 100 tons at 133 feet. The stability of the crane is maintained by four great tubes, 15 feet in diameter at their bases, filled with concrete, and sunk 74 feet below ground.

Planer Practice in Modern Shops

Special Correspondence

Some of the ways in which planer work of various kinds is done in modern miller and other shops.

Several good examples of string work or planing a number of pieces at one setting so as to make a long cut before reversing are shown herewith.

Two rows of four each, eight miller tables in all, are shown in Fig. 1. This shows how they are held against small angle pieces located in the outside T-slot of the planer table; these pieces fitting the angle of the dovetail slide on the lower part of the tables being planed. The work is forced against these by the small pieces which convey the pressure from the screw stops. The thrust of the tools is taken by the stops at the end.

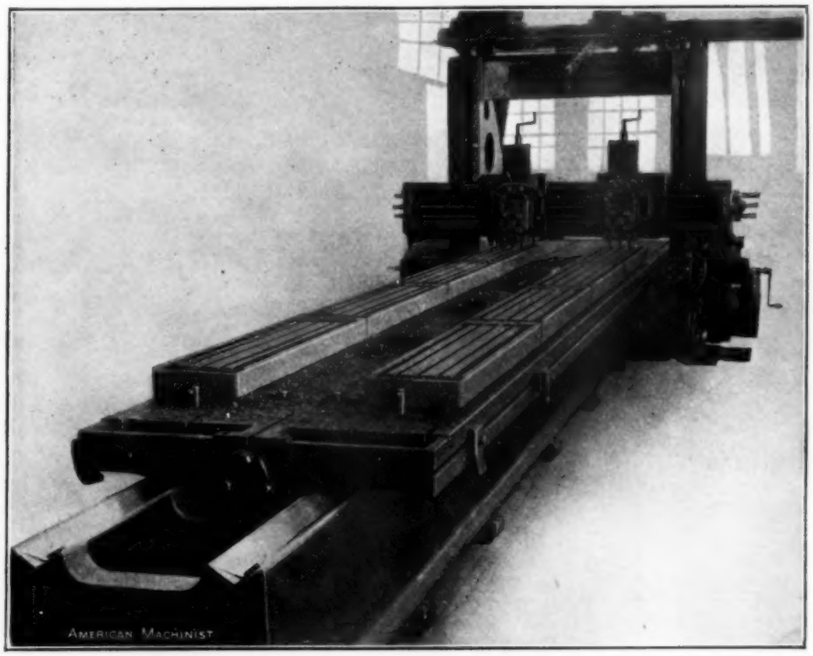


FIG. 1. PLANING EIGHT MILLER TABLES AT ONE SETTING

PLANING FOR TAPER GIBS

The next illustration, Fig. 2, shows 12 miller saddles being planed for the taper gibs. The spacing and locating blocks which can be seen between the two strings of work fit into the center T-slot and are made at the right taper with the table slot so as to throw the saddles around as can be seen. The way the work is held down shows practical methods and it will be noted that in this case it was found better to use the heads of the screws in the screw stops. The method of bridging the pocket in the end of the planer table to get a good bearing for the strap and the clamping piece may also be worth remembering.

A GOOD PLANING FIXTURE

A sensible time-saving planer fixture is shown in Fig. 3. This is for planing the bottom and the key of two saddle nuts at one setting.

The nuts rest on the V's *A A A A*, being held in the center by the double-ended finger strap *B* and at the outer ends by similar straps *C*. These have small jack screws in the outer end to give a support when they are pulled down in the hole by the bolts shown. A similar clamp holds down the other end.

The planed V in which the work rests is parallel with a key on the bottom of the fixture, so that it is only necessary to slip the key into a table slot against a couple of stops to take the thrust of the tool, clamp the whole thing to the table by straps on the projections on the end and go to work.

The standard steel block *D* fits into a dowel hole in the base and is squared by the two small pins shown near the base of the block. The top of this has a key which is the correct size for the key to be planed and it is also the correct distance from the center of the nut. So, instead of measuring distances, the tools are set by the steel block and the nuts come out all alike and with the key in the right place.

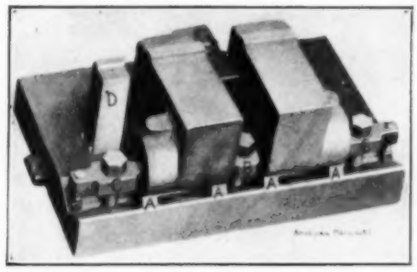


FIG. 3. TIME-SAVING PLANER FIXTURE

ARMS FOR VERTICAL DRILLERS

In Fig. 4 is shown a string of six vertical driller arms being planed with relation to the spindle holes which have already been bored. The arms are mounted on a mandrel which fits the spindle holes of all six pieces and the mandrel located on the planer table in the blocks *A A A* being clamped by the strap *B* and the end thrust taken by the cross piece *C*

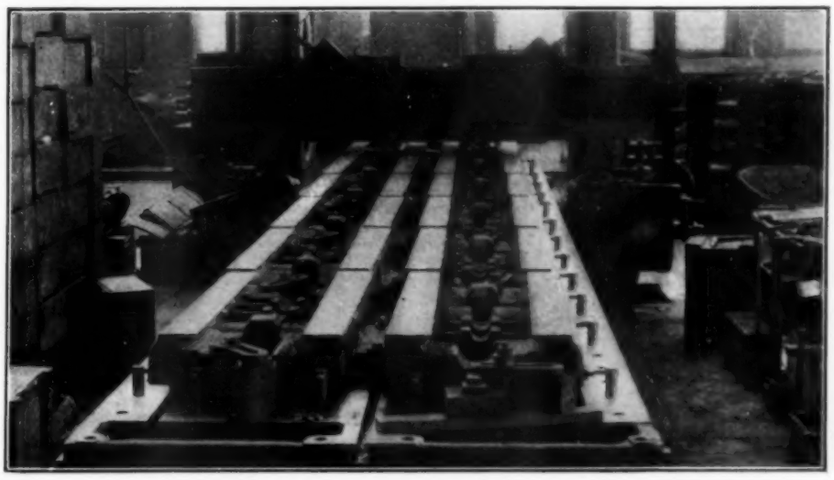


FIG. 2. PLANING TWELVE MILLER SADDLES

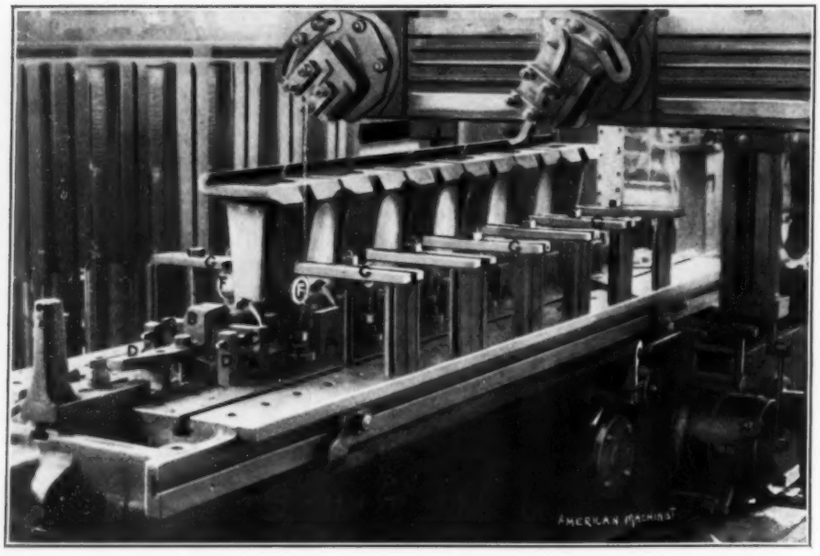


FIG. 4. PLANING ARMS FOR VERTICAL DRILLERS

and the end stops *D D*. The planer jacks *E E E* are adjusted up under the lugs of the cross holes *F F* and form supports for the straps *G G G*. By this means the arms are all located correctly with relation to the spindle hole, all the plain and angular surfaces being finished at the one setting and with very simple tools.

PLANING TAPER GIBS

A convenient and rapid method of planing taper gibs is shown in Fig. 5. The central fixture is a channel provided with a raised center rib for supporting the gib while it is held by the six sharp-pointed screws which are inclined so as to force it onto the seat. It will be noticed that there are small lugs or projections cast on the gib for these screws to bear against, giving them a good footing and preventing injury to the gib itself.

After the flat sides are planed the gib is held in another fixture as shown in Fig. 6, for planing the sides or narrow surfaces. The further side of the fixture is undercut to the same angle as the slide the gib is to fit, the gib being held against this inclined side by the four screws pressing against the four short bearing pieces shown. This makes it easy to plane off the surfaces at their proper angle without any measuring on the part of the planer man.

USING ROUGHING AND FINISHING TOOLS IN THE SAME HEAD

A very neat method of finishing flat surfaces is shown in Fig. 7. The fixture itself is held by the four screw stops which fit into the holes in the planer table. The inside edges of the fixture are taper and taper jaws are drawn down against the work by the screws whose heads are underneath the fixture. This holds the pieces firmly in place.

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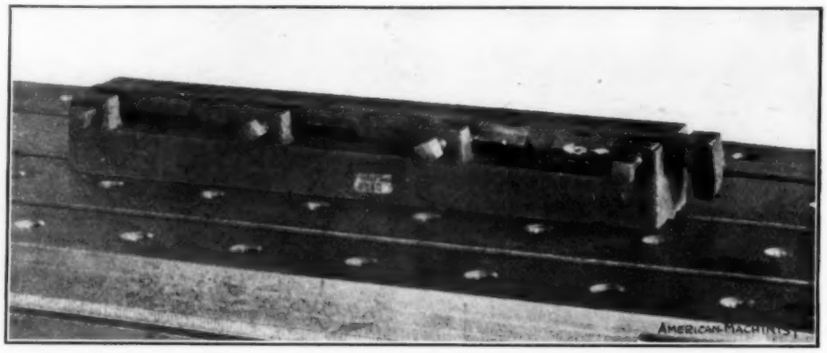
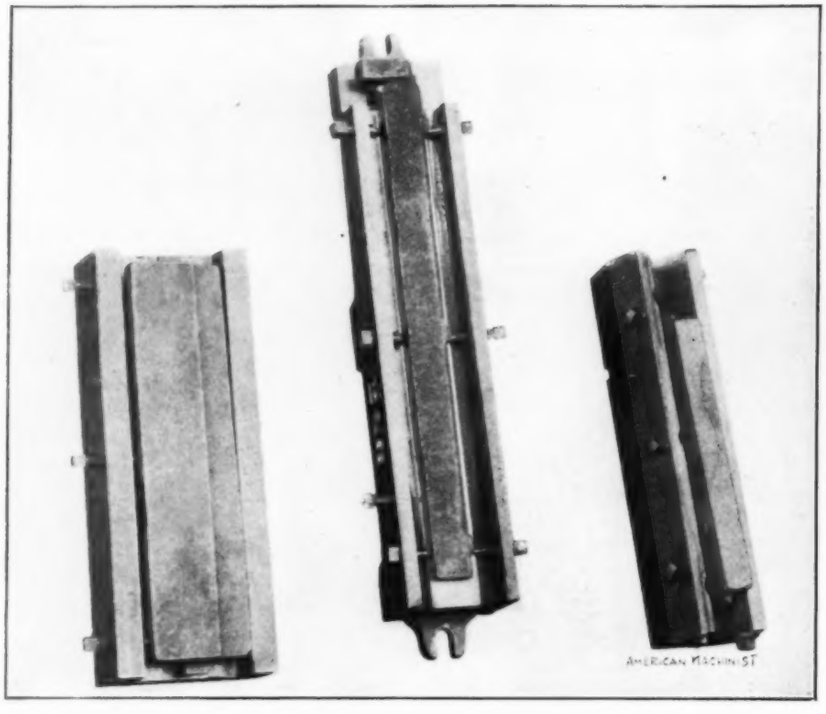


FIG. 6. PLANING NARROW SURFACE OF TAPER GIBS



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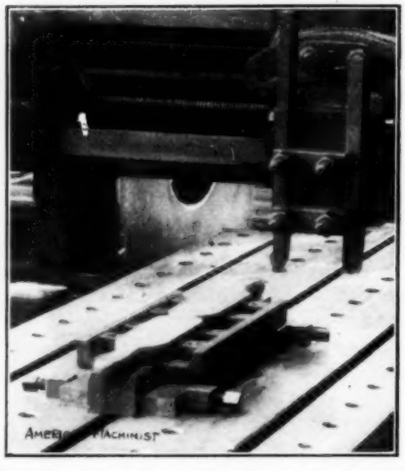

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CASTING HOLDING PIECES ON WORK

It is often very dangerous to cast

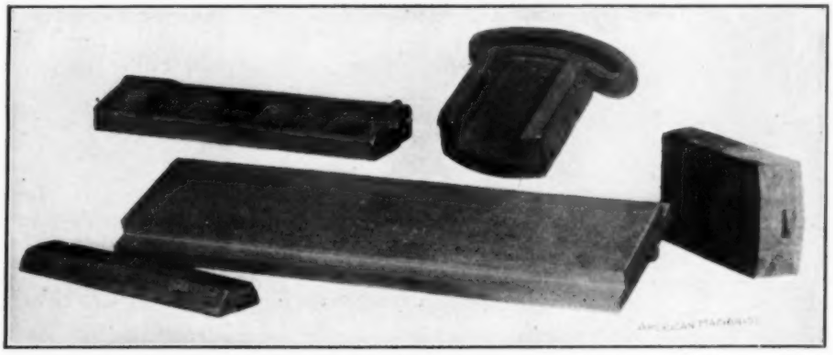

FIG. 8. HOLDING LUGS CAST ON WORK

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It not only serves as a locating point in the fixture but is for a fulcrum pin in the finished scraper.

To Taper a Copper or Brass Tube

BY J. H. HARRIS

Tubes or pipes of brass or copper can be tapered or reduced in section by gripping the tube or pipe in the lathe chuck and applying pressure to the rapidly revolving tube with a blunt, highly polished, hardened and suitably shaped steel tool such as metal spinners use.

Sometimes it is necessary to have a long tapering tube that is too small to stand the pressure of the spinning tool. In this case, a pair of pliers can be used, with rounded and polished jaws.

To reduce or taper a tube, grip it in the speed lathe chuck and apply the pliers close to the chuck while the lathe is in motion, increasing the pressure on the handles of the pliers as they are fed toward the projecting end of the tube. Pass over the tube this way until desired reduction has been obtained.

By this method, tubes have been reduced or tapered from ¼ inch in diameter to 1/16 inch in diameter in 6-inch and longer lengths.

FIG. 2. FACEPLATE AND WORK

Machine ToolBuilders' Report

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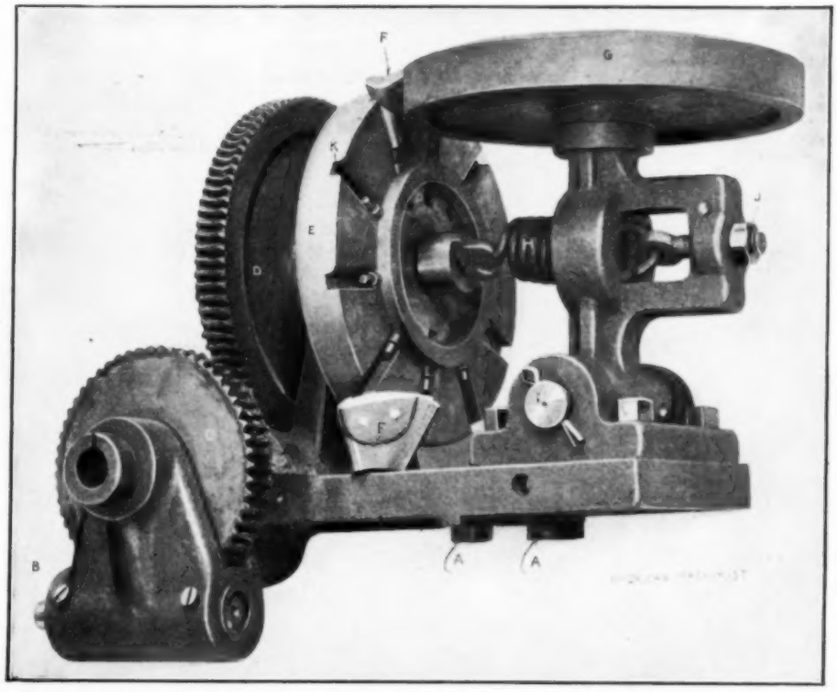

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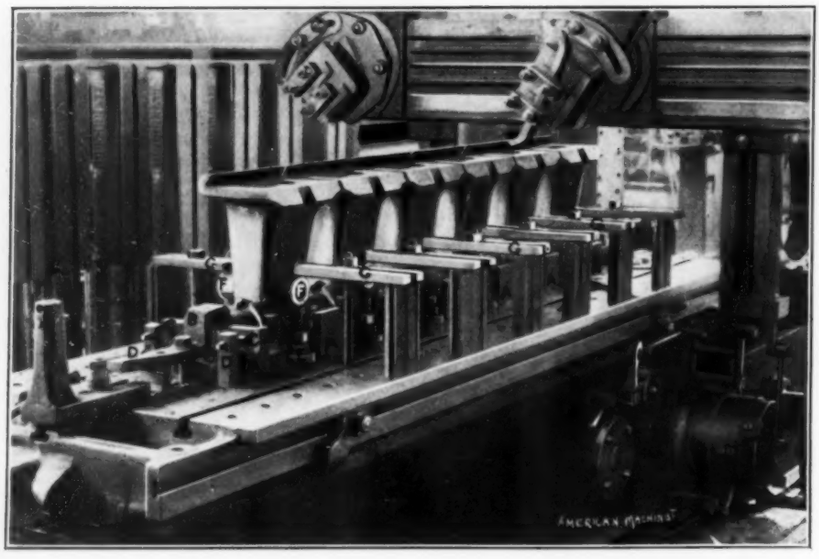

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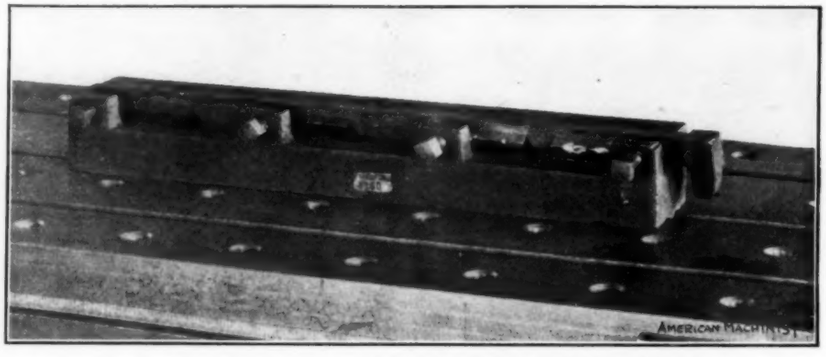

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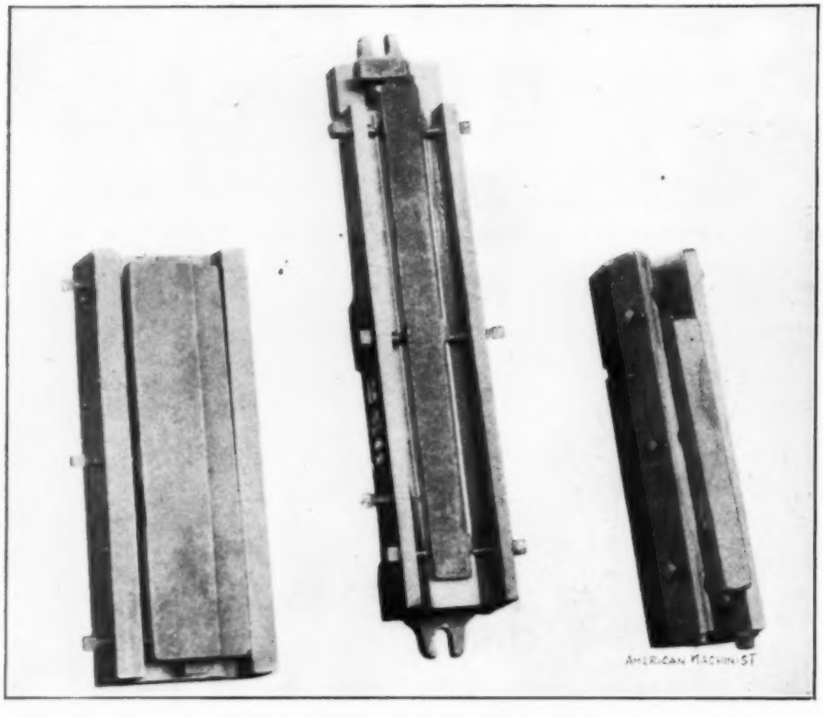

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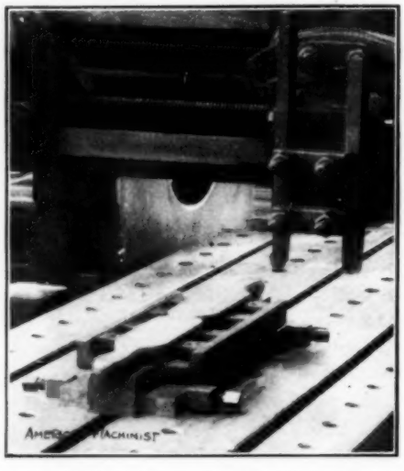

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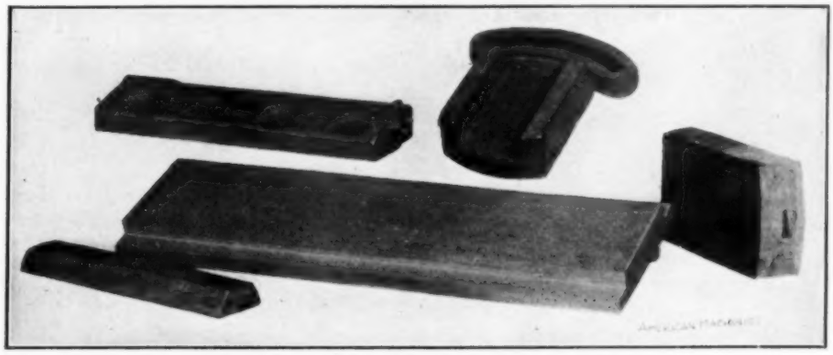

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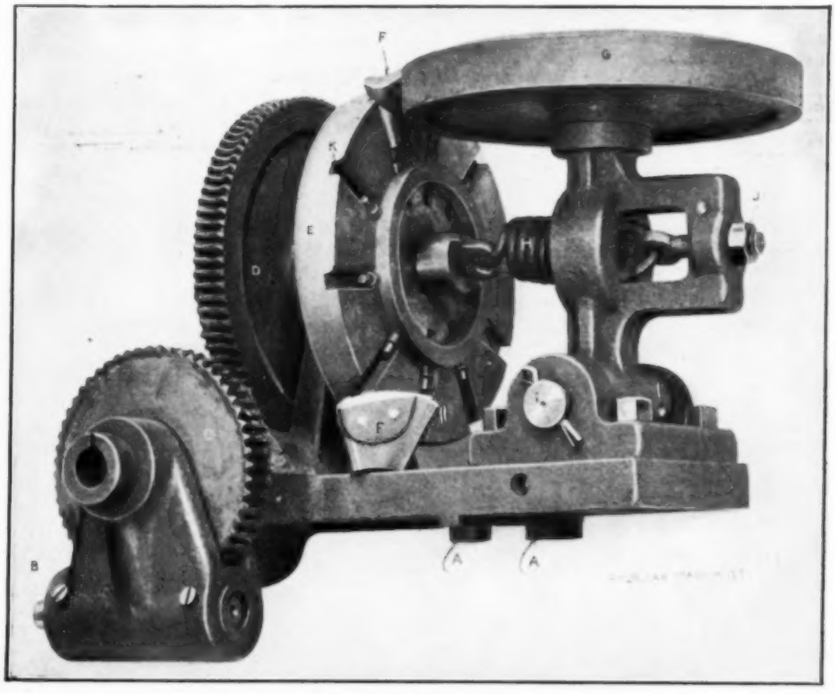


FIG. 1. CONTINUOUS MILLING FIXTURE

Foundry Work on the Landis Grinder

By E. A. Suverkrop*

The flat surfaces of this grinder, which are subject to wear, are cast against chills which render them hard, close grained and durable. Chills are also used at certain parts to prevent shrink holes.

*Associate editor.

The surfaces subject to wear on the Landis grinder, built at Waynesboro, Penn., are cast on or against chills. This gives a strong, close-grained, hard, wear-resisting surface just where it is needed.

Fig. 1 shows a chill rack in the Landis foundry. At *A* are chills for the V's and at *B* chills for the flat ways. The V's and flat ways are the important parts subject to wear where chills are used, but there are other points at which chills are employed to produce sound castings. Exclusive of these points the iron is cast in dry and green sand cores.

Fig. 2 shows the beginning of the molding operation. The iron skeleton frame *C* is clamped to the core box pattern *D*. The chills *A* and *B* and the anchors *F* are then set in their respective places. The chills are separated about ⅛ inch from each other with stiff blackwash between, so as to prevent buckling due to expansion when the hot iron strikes them. At *E* in Fig. 2 is shown a core print which locates the core in the V for the oil pockets, the other prints for this purpose being obscured from view by the skeleton frame. After the chills and anchors are in place, the skeleton frame is filled and rammed in the usual way. When this is completed the clamps are knocked off and the frame, with the chills imbedded in the sand, is turned over, dressed up by the molder and dried in the core oven. This frame with its inclosed core, after being washed, forms the bottom of the mold.

FIG. 1. CHILLS AND ANCHORS

Fig. 3 shows the molding bed. In the center is a pit about five feet deep forming a convenient receptacle for the sand when the completed casting is being knocked out of the mold. Across the top of this are a number of bars *G* to support

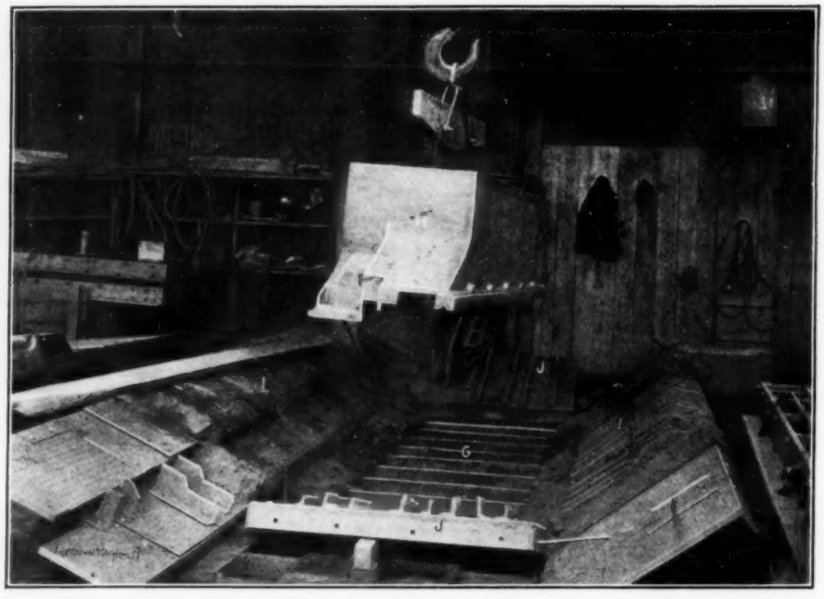


FIG. 3. THE MOLDING PIT

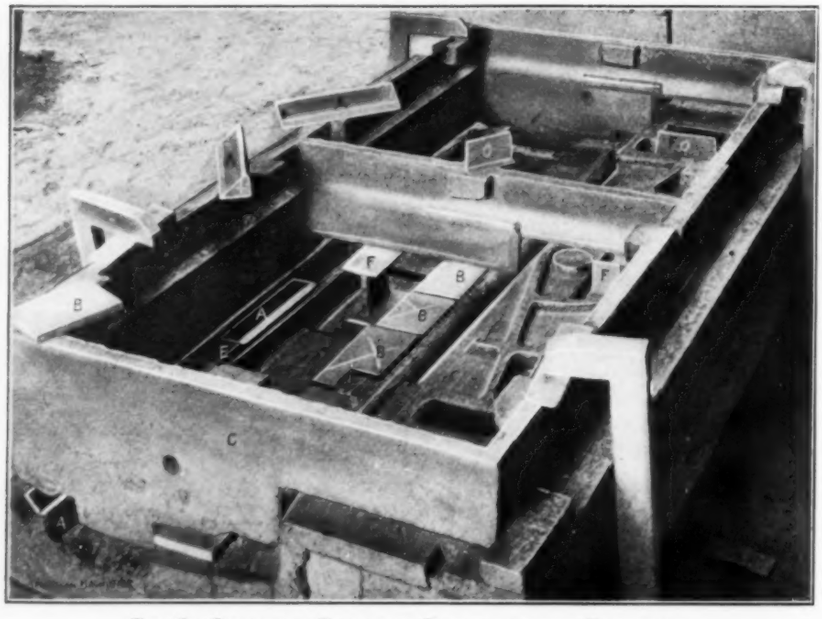


FIG. 2. SKELETON FRAME IN PLACE ON THE PATTERN

the cores which form the completed mold. The view of the molding bed was taken just after the removal of a casting, the sand of the side cores still remaining in the hinged cheek pieces *I*.

The skeleton frame *C*, Fig. 2, is placed face up on the bars *G*, Fig. 3, and the pattern *H* is lowered down on it, care being taken that the frame and core *C* and the pattern *H* are correctly located with relation to the hinged cheek pieces *I* and ends *J*.

The cheek pieces *I* are swung up into vertical position and the side cores are made of green sand. After arranging the parting at the corners, the end pieces *J* are swung into position and the ends are made. When swung back from the pattern, the sides and ends are finished up by the molder. In the meantime the cores for the center have been made. For small machines the center core *K* is in one piece as shown in Fig. 7, but for the larger machines the cores are in several pieces as shown in Fig. 4. As previously

stated, chills are also placed in the inside cores to prevent shrink holes by congealing the metal quickly at these points. Fig. 5 shows the chills *A* placed in a core for this purpose, the long rod cast in each chill holding it in the sand. they affect the casting to a depth of about 1 inch.

Fig. 4 shows a mold ready for closing with the center cores *K* in place and the hinged green sand sides *I* and ends *J* ready to swing up in place. The weight of the center cores is carried by the anchors *F*, Fig. 6, which also determine the thickness of the metal in the top of the frame.

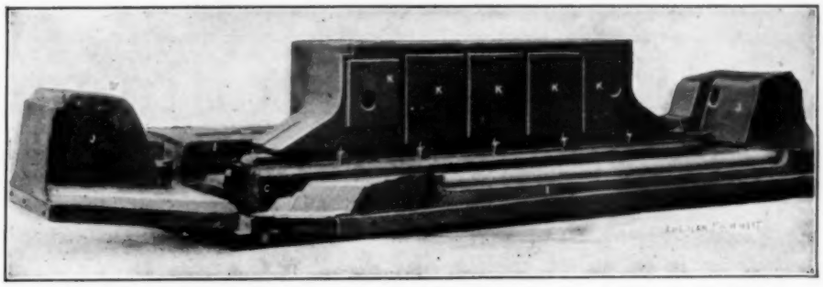


FIG. 4. INSIDE AND OUTSIDE CORES OF A LARGE FRAME READY TO CLOSE

FIG. 8. CLOSING THE MOLD

The chills used are just rough castings of the desired shape with or without rods cast in them to assist in holding. They average about ½ inch thick and

FIG. 5. CHILLS IN INSIDE CORE

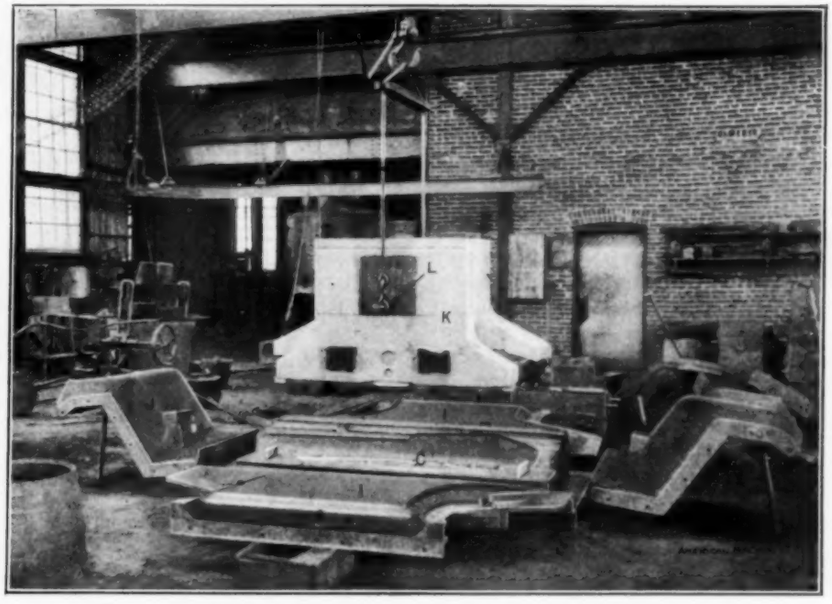


FIG. 7. READY TO PLACE THE CENTER CORE

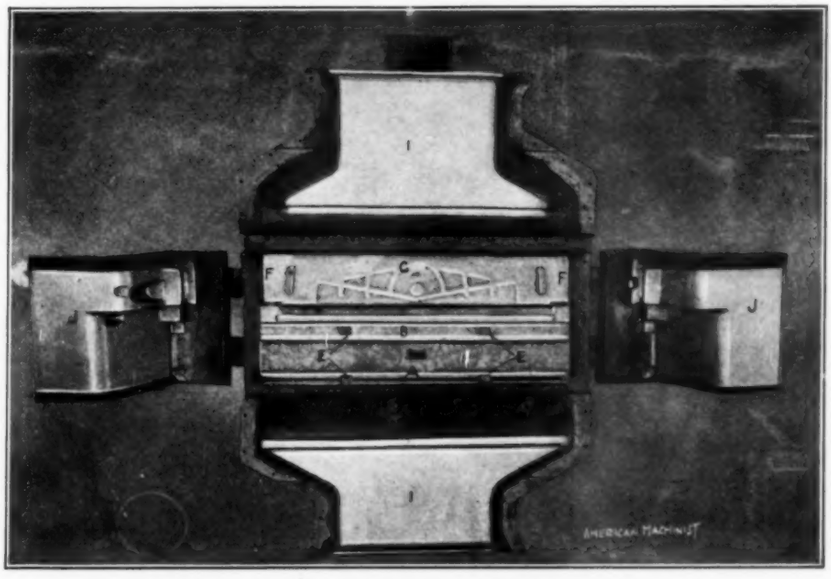


FIG. 6. LOOKING DOWN ON AN OPEN MOLD

Fig. 6 is a plan view of a similar mold for a smaller machine. *C* is the bottom core with the chills *A* for the V track and *B* for the flat one. *F* are anchors and *E* locate the oil pocket cores.

Fig. 7 shows a mold ready to close. At *L* is a pipe through the core in which is placed the fulcrum on which the core is hung while being dressed by the

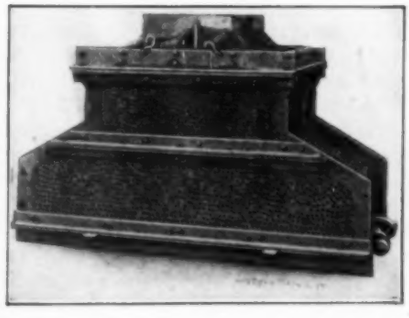


FIG. 9. THE MOLD READY FOR POURING

molder and handled in the crane. Fig. 8 shows the molders closing the mold. Fig. 9 shows a closed mold. It will be noted that the side and end plates are full of holes for the free egress of the gases.

To mold a bed weighing 8600 pounds, takes two men 18 hours on the mold; one man 18 hours on the skeleton frame, and one man 36 hours on the center cores. Barring mishaps, the casting can be poured in 45 seconds. The larger beds are cleaned by hand, but beds up to 4875 pounds (the number 25 grinder) can be accommodated in the sand blast room. These take about half an hour to sand blast. The Pangborn system is used with 90 pounds air pressure and coarse Cape May sand. The smaller beds are left in the sand over night and the larger 48 hours.

After cleaning, the castings are stored in the yard where they remain until the rough planer is ready for them.

Production in Textile Machinery

By W. H. Booth

The possibilities of the automatic machine in the production of parts for textile machinery depend upon the increase in the number of parts that occur in multiples.

There is a large quantity of small repetition work in the manufacture of textile machinery, but from all that is known of the business it is unlikely that anything like the full value of automatic machinery has been brought into use. Every maker of machinery, as the phrase goes, is supposed to know his own business best. Therefore, it lies with the maker of machine tools to teach his hoped-for client how money can be saved by a more thorough adoption of automatic tools. To effect this purpose, necessarily he must have first convinced himself that he is right and that he can offer something that will prove a commercial economy.

It is, therefore, first necessary that he should familiarize himself with the parts of a machine and its particular capacity for treatment from his special standpoint. If he approaches the subject as a novice, his first impression will be that the whole of a machine is very complex and that there is sure to be an enormous amount of repetition work. But he will find that this is not the case.

An Example for Consideration

Take, for example, the mule, an extreme illustration of the idea wished to be conveyed. A mule spinning frame may contain 1200 spindles. The spindles do not seem to lend themselves to production by automatic machinery, for they are of hard steel and ground to finish. Other very numerous pieces of the same shape are the cast-iron stands or brackets that carry the rollers. The upper rollers are plain and simple shapes of brass and of cast iron and these do seem to offer themselves as suitable pieces to be turned out of straight cast or rolled bar. So do the loose boss rollers, for it should be quite within the province of an automatic machine to produce sized pieces from plain bar. But, excepting rollers, the main length of the machine does not offer serious scope for automatic machinery. There are hundreds of weights of rough cast iron, hooks to hang them by, sickles and other awkward shapes, but not much short lathe work. The mule, in fact, contains all its real mechanism in the headstock, and in this headstock every piece is different. Thus, for the 1200 spindles there is one of article *a*, one of *b*, one of *c*, and so on through a long list of things.

On the assumption that a factory contains, say the very usual number of 60,000 spindles, these would be represented by fifty headstocks in which there would be fifty of *a* and of *b* and so on. There would be one hundred of the wheels to drive the line of rollers on either side of the headstock, and most of the headstock consists of small and medium gear sheets and short lengths of spindles. Now, gear wheels are scarcely suitable for automatic work. If machined in automatic machines, these must be of the hopper variety to deal with rough cast blanks or stamped steel blanks. The spindles alone remain for treatment on rod feed machines. Many men object to automatic work on steel shafts and bolts because, as they say, the steel used is of bad quality—almost necessarily so if it is to work nicely in the machine.

In making a bolt, the best of the rod is cut away to form the head, and the shank of the bolt is the worst part of the steel. One of my friends dropped automatic work entirely on large bolts for this reason, and went back to the forging machine which drew down the shank from the larger bar at no waste of material. He told me that this was not only better, but cheaper.

Field for Automatic Machinery

But in textile machinery, there are very numerous small bolts. Those which attach the stands to the roller beams are very numerous, and, as they are small, may quite well be produced on automatics.

This mention of bolts brings up the thought that, if automatic work is to secure its maximum economy, it is essential that the process should begin in the drawing office. Machines should be designed with a view to a reduction of small parts into a minimum number of classes. There should not be bolts of 1½ inches and 1¾ inches in length if one length of 1⅝ inches can be designed. For automatic working, not merely bolts but other little things should be made similar as much as possible. Much the same may be said of the ring spinning frame. Such a frame may have only 400 spindles, but its headstock, as compared with the 1200-spindle mule frame, will be proportionately less complex.

Slubbing and other speed frames are all parallel cases. There are numerous plain short rollers, and the headstocks again simply so many gear wheels and small shafts. Except the small skew bevels of the spindle drives, each gear wheel is different in size from the others; for textile machinery is essentially a mass of rotating parts having different velocities. Automatic work, apart from rollers and bolts is thus chiefly to be applied on the feed hopper system. In ring frames, the spindle bearings might be formed from rods or tubes and so might the rings themselves. But, generally, the amount of automatic work will not be so great as might at first be thought likely.

An Opportunity for Extension

However, there does seem to be an opportunity for further study of the subject with a view to adopting automatic work to the needs of the textile machine maker and in the direction of modifying details by way of reducing the number of differences and enlarging the number of parts in each class.

There are enormous numbers of gear wheels in all textile machines and the turning of these is perhaps most cheaply done in the circular milling machine. This machine has been employed for many years in English textile shops for turning gear blanks, and it has also been employed on cam shaping, but it has not been found satisfactory for this latter work where the departure of the cam from the circle is at all marked. The difficulty, of course, is that the cam to be cut is governed from a shaper or pattern cam and the feed and pressure are not sufficiently positive and rigid.

If the automatic machine is to be extended beyond the range of bolts and pins, for which, it can already be assumed, it is used to some extent, the

machine maker must study its suitability for parts that are now separately cast and he must make these from long cast rods or he must employ hopper-fed machines to deal with separate, cast blanks.

It is extremely difficult to get machinery makers to depart from their established ways. Numerous small parts are turned very rapidly by hand and this is especially the case with the brass work of small cheap hand pumps. In a works making these articles I have watched the small amount of machining put upon such parts as the bucket and mushroom valve and its seat. For the class of work, neither gage systems nor systems of machining appear to be needed, for the parts are made near enough for the degree of interchangeability required without any careful gaging.

Accuracy Required in Textile Machinery

But textile machinery has of late years emerged from this class. Gear wheels are cut in place of being cast very rough with no pretense of accurate tooth forms, and gaged accuracy has been introduced in place of skilled fitting. There ought, therefore, to be scope for the introduction of further advanced methods, but at the same time it must not be thought that the multitude of things which are alike pertains to the head of a machine. It pertains only to the outer body. It may be said that only the spinning operations beginning with the drawing frame offer a multitude of the same piece in one machine and these are outside the headstock.

For the headstocks, the number of things alike is dependent upon the number of whole machines made, and, as shown above, the ratio of the two cases may be as low as 1:1200, in the extreme case of the mule. It is not possible or practicable so to design a textile machine that the gear wheels shall not be a trifle different in size. In a machine tool, the variation of the ratio of feed to revolution is not vital. The same variation might be vital in a textile machine that demands absolute ratios.

Methods Should Be Known

One maker of textile machines advertises that the rings of his ring spinning frame are made of steel on special automatic machinery, but here the information ends. The same maker advertises draft gears cut out of solid blanks, the smaller gears to be of steel case hardened. Another maker advertises the rings of the ring frames to be stamped from solid steel bar and turned on automatic machines. Does this really mean that they are made on a rod-feed machine?

In short the information vouchsafed is rather for the layman than for the machinist and facts are concealed behind mere sounds which do not carry information. There is still a good deal of reserve in the making of textile machinery. It might benefit the makers to be more open. Anyone can see the machines they make. Is there any good reason to hide the shop operations or methods?

Systems of Fixing Wages

By Entropy

Any system of wages, no matter how attractive to a few, must be considered as applied to the many before it is declared a success.

Straight piece work administered in a perfectly honest, square way and paid to perfectly honest, square workmen is ideal. If this system had been only recently discovered; if the rates had been set by actual investigation of the time necessary to perform the elemental operations; and if there was some way to prevent cutting of rates once established, then this system could not be bettered.

As it is, any shop adopting piece rates should have "Lead us not into Temptation" printed in large red letters on every pay envelop, and posted in every conspicuous place in the shop, and the same placards used for wall paper in the office; for this system is full of temptations.

Unfortunately, no system, no matter how well born or how carefully nurtured, can always remain under the control of its parents, and while we may admit that an institution is but the lengthening shadow of some great man, we have to realize that a shadow cast on irregular ground may have little resemblance to what casts it.

We believe that there are today more employers than ever before who appreciate the virtue of a square deal, but we question whether a large part of them are proof against the temptation to squeeze the other party all that he will stand, and we also question whether many employees are proof against the same temptation. The matter is further complicated by the fact that it is impossible to say in any given case just what distribution of the selling price should be made between employer and employee, between producer and seller, between labor and executive ability. The difficulty is made greater by the overlapping of their functions.

In the past this division was once made by the system of slavery in which the privilege of existence was the wage paid for the performance of a task. Then followed the charity system under which men were allowed to work in a happy go lucky way and paid whatever the employer in his beneficence saw fit to allow them. Now has come the fighting system under which men have found that they have, in their labor, a commodity of real value, which is salable and which has a market price which varies from time to time and place to place. He has discovered that labor is mobile; that instead of hibernating if the shop next door shuts down, he has a radius of action of hundreds of miles. This very mobility of labor, however, aids the employer in that it enables him to pick from a larger field. Its net result is a greater respect on the part of both employer and employee for each other.

In the end it would seem that some premium system of payment would have to be adopted whereby men of varying ability can work side by side, with their compensation dependent on both physical and mental exertion, and yet also dependent on the executive ability under which he is employed, and that would allow each man to choose his vocation with regard to his temperament as well as his physical qualifications and reward him for the exercise of whatever initiative he may have. It is a fact that many men deliberately prefer to work for low wages at congenial work when they are fitted, in everything but temperament, for higher paid work. Any system that weeds out these men and appeals only to the pocket book is unfortunate for it is to just such men as these that we must look for the future highest development of the nation.

A Blueprint Sign Made without a Tracing

By John N. Moeller

I made a blueprint with neither tracing nor ink. All draftsmen know that making a large sign that requires large letters is a long, tiresome job. It is difficult to make the tracing lie flat after the ink has dried, as the ink shrinks the tracing cloth and a blurred print results.

To overcome these difficulties, I laid out the sign on heavy drawing paper and with a sharp knife and a steel T-square and scale cut out the letters from the paper; thus, actually making a stencil of the sign.

Using this stencil as one would the tracing, I made a blueprint. Each letter stands out very clearly. One advantage of this sign is that the letters are blue instead of white and can be seen further.

National Metal Trades Proceedings

A synopsis of the proceedings of the thirteenth annual convention of the National Metal Trades Association, held in New York on April 12 and 13, has been mailed to members and others interested in the field of work in which the association operates.

The subjects covered at this meeting were of a generally interesting nature and a record of the proceedings forms a useful contribution to contemporaneous literature.

Workmen's Compensation in the U.S.*

By James A. Emery

By "workmen's compensation," as distinguished from employers' liability, is meant a system in which provision is to be made for fixed limited compensation for substantially all injuries received in the course of employment, irrespective of the fault of employer and employee, except such injuries as are either self-inflicted or are due to such misconduct on the part of the injured worker as directly tends to imperil life and limb and to compensate which would encourage recklessness.

I understand by employers' liability a principle of law by which indemnity or compensation for injuries received in the course of employment rests upon the proven fault, actual or imputed, of an employer, or him, who in contemplation of law, is his agent in relation to an injured worker.

In our country, we find a recognition of the failure of the present system to adequately adjust liability for personal injury in employment, so as to meet either modern conceptions of personal responsibility or with sufficient flexibility to bend the common law to the vast and revolutionary changes of modern industry.

Universal Mutual Insurance System Best Remedy

We all agree that the happiest and most practicable remedy that could be devised would be a condition of universal, voluntary mutual insurance, in which associations of employers, organized for the purpose of maintaining and administering insurance for compensation of this character, would give the same business management to that subject, to actuarial supervision and suggestion that would be given to any form of insurance, but would save the cost of commissions and the management of a private insurance concern. But what we need, in the first instance, in order to secure compensation in some form of compulsion, for voluntary compensation will never be universal in its application.

We have today, in many parts of the country, notable instances of great manufacturers who have expended thousands of dollars in the establishment of splendid systems of private compensation insurance that will compare with any system of a similar character in Europe, but they are not universal, and our problem is not the problem of the big employer; it is the problem of the small employer, because the small employers in the aggregate are the large employer. On the whole, the man who averages 10 or 15 employees, employs more men than all the other employers of the United States put together, and the small employer is the one who hesitates to add to his overhead charges; he is the man that will not individually inaugurate a voluntary compensation scheme; he cannot afford it alone, and he is the man upon whom compulsion must be applied, if compensation as a system is to be universal. And surely we must agree then that if compensation is to confer any advantage as a substitute for the present system of liability, it must completely take the place of the other system and the remedy must be exclusive and forbid any appeal to law, otherwise we have merely created two liabilities, one at law and one through compensation, and you place upon the employer the burden of double insurance, one to carry his obligation under a compensation system and the other to carry his risk at law. Furthermore, if such a system is as beneficial as we believe it to be, then it should be for the benefit of all, not for the benefit of some. Its burden is to be distributed upon all and not upon some. It should then be universal in its application, and applied to all forms of employment, for if German experience and European experience for 25 years proved anything, it is that our conventional notions of the relative hazard of industries must yield to the teachings of experience. In Germany they have discovered, through 25 years of investigation, that perhaps the most hazardous of all employments, taken in the totality of its injuries, is agriculture, which holds the highest percentage, either in deaths or permanent injuries and disabilities.

The most practicable remedy would be a condition of universal, voluntary, mutual insurance, in which associations of employers would give careful business management to the subject, but would save the cost of the management of a private insurance concern.

"A sound compensation system should be based upon mutuality of taxation, because both employer and employees are the responsible causes of accidents."

"A provision for exemption from taxation would stimulate the creation of a universal, private, systematic, mutual, social insurance, thoroughly American in its character."

"What we need in the first instance, in order to secure compensation, is some form of compulsion."

*Excerpts from an address delivered at the annual convention of the National Lumber Manufacturers Association.

Mutuality of Taxation

Furthermore, a sound compensation system should be based upon mutuality of taxation, upon the contribution of both employer and employee, because both are the responsible causes of accidents, both have the prevention of accident within their control, and both should contribute to the cost of eliminating the evil. When you have placed upon the employer the cost of accidents due to the hazard of the industry, for accident due to the employer's own fault, and for that element which represents the fault of both the employee and the employer, upon what principle of natural justice can you also charge him with that proportion of accident due solely and exclusively to the fault of the employee? Especially when you are giving to the employee, in return for his contribution, not a right of recovery such as he now practically has, a recovery estimated at six times in one hundred actions, but substantially speaking 98 or 99 times out of every 100 cases of injury.

The exercise of the taxing power always has been accompanied by exemptions in the public interest, provided the thing aimed at is secured by exemptions, for it would be in the public interest to give to a system, either of one employer or of many employers in conjunction with their employees, who provide an equal or superior benefit to that aimed at by the law, exemptions from taxation—it is, I say, as much a public purpose to do that as it is to lay a tax upon them, in the elimination of the evil aimed at, and if the evil is more successfully eliminated by a more efficient and better system of social insurance under private management, then there is no reason why the State tax should be laid or paid in to the State groups of individuals to provide that which the State sought to secure.

Under such a system, if you once secure the compulsion necessary to establish a scheme of compensation, a provision for exemption by which you give im-

pulse and encouragement to all forms of private enterprise that undertake to perform the duty which the State seeks to see executed, instead of creating a bureaucracy, you would provide an impulse toward the creation of a general scheme thoroughly American in its character, of universal, private, systematic, mutual social insurance. Operating under such powers and giving the State such authority, you have done no evil to your institutions; you have not distorted private relations; you have not done violence to the law of contract or to the law of tort; you have preserved every guarantee of your constitution; you have preserved the self-reliance and self-respect and independence of the employee; you have not created a habit of dependence from which England is suffering today; you have cured a vast social evil; you have set on foot an impulse for national industrial efficiency. Nor would you have summoned to your aid a novel power. You have called into being that power which you daily exercise for the protection of the improvident, or those who fall by the wayside or cannot keep up with the procession, who find refuge in your poor houses and eleemosynary institutions; the power which takes the hopeless drunkard from the gutter, wrecked by his own act, and makes him a State charge. You will have prevented the social submergence of a portion of your population threatened by the economical consequence of the injury falling upon the shoulders of the injured man, instead of being distributed through the employment in which the injury occurs.

If it is social self-defense to provide for the education of a nation in order that the coming generation may be able to intelligently perpetuate the institutions that this generation hands down to them, if it be social self-preservation and a public purpose to provide for the injured and the maimed and the blind in our public institutions, if it be for a public purpose and for social preservation to protect the health and the strength and the morals of our nation, then it is social self-preservation, it is social insurance, it is social self-defense to provide that, where an army must suffer in the course of carrying on the world's industries and must continue to be the victims of the way in which the world does its work, social provision shall be made against this destruction and waste of life and working capacity.

A rather noteworthy application of the oxyacetylene process is a cutting plant arranged for six operators by the Linde Air Products Company for use in connection with the salvage of the battleship "Maine," now raising in Havana harbor. Much of the work involved is the cutting of 9-inch armor plate as well as the more usual structural shapes.

Two Ways of Reorganizing a Shop

By John R. Godfrey

There are several ways of rejuvenating an old plant and each has its advantages. Perhaps the easiest is the method which has been all too prevalent in the railroad shops. This consists in having the new S. M. P. fire every man on the job from the sub-boss up and replace them by his own retinue of men who follow him from place to place. In this way he maintains a body of assistants who know his methods and who are not obstructing his work in any way.

But the uncertainty of positions of this kind sort of keep the men guessing and they probably have a series of strenuous interviews at home when the time comes to move just as families are getting acquainted and the children are getting on well in school. And, aside from the unseen troubles of this kind there is the disadvantage of the new men not knowing all the ins and outs of that particular shop. For, while there are certain broad principles of management, each business has its own peculiarities which the older men know.

A friend of mine recently took over an old shop where moss was over the door and the ruts were a foot deep and he is pulling it out by using the old men with very few exceptions. After he found out how really bad it was, he called in all his foremen and laid out his plans in detail. He showed them exactly what he proposed doing and told them he wanted their help. Using the tact he had been accumulating during a long business contact with men of all kinds he straightened out the kinks—broke up the cliques that are always found in an old shop and found out that his men were really willing to do things his way.

Then he sent his superintendent and foremen out to visit other shops and absorb ideas. When they returned he called them together and asked if they had seen anything which they could apply in improving their departments. And that, if they had, he should expect them to bring him plans to show how they would apply the ideas and improve their work in various ways. They were given a month to do this with the understanding that if nothing in the way of a plan materialized by that time, they would probably find it more comfortable in some other shop.

It is interesting to note that nearly every man made good. Some more than others as was to be expected, but with practically the same organization, the shop is doing better work at less cost than ever before.

This has the advantage of retaining the accumulated knowledge and experience of the older men, much of which it is impossible to tabulate on cards or otherwise.

Of course, there are cases where it is absolutely necessary to get rid of the old men on account of their ingrained disposition to oppose anything new. No manager can stand for opposition too long without jeopardizing the success of his plant or wearing his nerves and disposition to a frazzle. But it pays to err a little on the side of leniency if by so doing you can win over the loyalty and support of the men who know the little details better than you can learn them for a long time. But don't make the mistake of expecting loyalty without giving something to be loyal to.

Boring Straight or Taper Holes

By J. B. Kay

In boring cylinders closed at one end, from 6 to 12 inches diameter by about 4 feet long, making it necessary to use a heavy boring bar supported in the center and at one end, it seemed impossible to get straight holes, which in this case were essential. With the machine in perfect alinement the holes would invariably be a few thousandths larger at the back end, which was more detrimental to the job than if the holes had tapered just the reverse. After about a year of experimenting with different forms of cutters to no avail, it was decided it was caused by the heat generated while boring, which finally proved to be correct. The cutter head started in cold and would gradually warm up and expand, causing the hole to be larger at the back end. Now we heat the cutter head at a convenient fire, and start it in warm and the cylinders are coming from the mill by the hundreds practically straight.

Another case of boring cylinders of a different kind, the above results were reversed, the cylinders were open at both ends and would invariably be smaller at the end the cutter came out of. In this case it was desirable to have this particular end a trifle larger. If we had thought of it in the first place, it would have been better to bore from the opposite end, but it would mean quite a large expenditure to change over.

This difficulty was overcome by a double-end finishing cutter, each end with a separate adjustment by leaving 1/16 inch for a finishing cut, then setting one end ½ inch ahead of the other, and cutting out nearly all the stock with that end, the other end followed up with a fine scrape that made an elegant finish, and the cylinders were a few thousandths large at the end the cutters came out at, just as we wished them to be. This was caused by the side that was taking the heavy cut. It would gradually dull and crowd over just enough to make the hole a little taper. While this method might not be good practice, it has worked satisfactorily on several hundred cylinders without once failing to come out right.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Table for Cam Work

This table shows the amount of clearance required on Brown & Sharpe automatic screw-machine cams to allow the cutoff tool to clear the stock before it is fed out to the stop.

In laying out screw-machine cams it is often overlooked that space should be allowed for clearance just after cutting off and before feeding out the stock. This clearance allows the cutoff tool to drop back far enough so that the stock does not strike the cutter when it is fed out to the stop. Some prefer to figure very close on cam work and do not allow clearance but depend on the cutoff dropping away while the cam revolves one-half of the space allowed for the stop, or, in other words they expect the cutoff to clear while the chuck is being opened, which is done on the first half or sometimes the first third of the stop lobe.

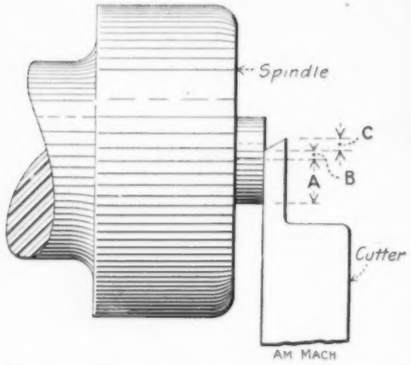


FIG. 1. CLEARANCE ON THE BROWN & SHARPE AUTOMATIC SCREW MACHINE

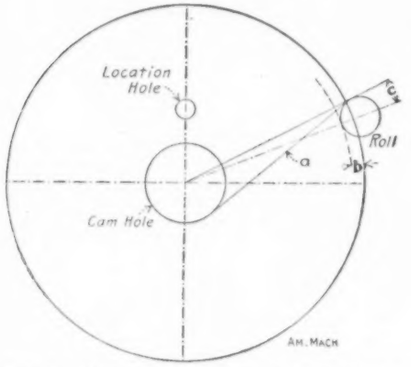


FIG. 2. METHOD OF MARKING OUT TABLE

Now it should be remembered that the cross slides are withdrawn by coil springs and that it is best to allow clearance and in this way make sure that the stock does not strike and break the cutoff tool. This is advisable on all diameters of stock and really necessary on work of large diameters. Fig. 1 shows the distance the cutoff tool would have to drop back to clear ¾-inch diameter stock on the No. 2 Brown & Sharpe automatic screw machine. First we have *A* (the dimension 0.375 inch) for ½ of the stock and then *B* (0.010 inch past the center) to face off the end of the bar and also the length of the bevel on the cutoff tool shown at *C*. This equals 0.015 inch for a cutter 0.093 wide and having a 15-degree angle.

With this method of figuring and using dimensions resulting from different diameters of stock and different widths and angles of cutoff tools the writer has made a number of layouts representing the drop on different cams, and in this way determined the minimum cam space which will allow the cutoff tool to drop back, not just to the edge but sufficient to clear the stock.

This table is shown in Fig. 3 and is shown for three sizes of Brown & Sharpe screw machines; as a slow drop is used on a cam revolving rapidly. The writer has given the tables according to the drops. As seen in the No. 00 tables we have ½ radius drop for a cam which makes a revolution in 6 to 60 seconds and ¾-inch radius drop on jobs from 0 to 6 seconds. By ¾-inch radius drop I mean the drop is struck from the high point of the cam tangent to a ¾-inch radius drawn from the center of the cam.

The different drops are given accordingly for the different machines and the reader may depend on these drops as being correct for the cam speeds given. Under each table is shown a note, as, cutoff tool 0.062 — 15 degrees = 0.017. This means that this was the proportion of the cutter used and that the extra travel for the bevel equals 0.017, also 0.010 inch to pass the center of the stock was allowed and besides enough to allow the cutter not to touch the stock when fed out.

An example of the use of the table, is, for instance, on the No. 2 machine on a job requiring 6 seconds to 90 to make a piece. The cam clearance required on 9/16-inch diameter stock would be 1½ inches but on ⅝-inch diameter it would take 2 hundredths of cam surface.

Fig. 2 shows how the table was worked out. *A* is the line representing the drop and *B* equals ½ of the diameter of the stock plus the extra amounts and *C* is the number of cam hundredths required. The reader will find this table handy because the operations of the cams are

No. 00 Using ½ Rad. Drop (6 sec. to 60 sec.)		No. 00 Using ¾ Rad. Drop (0 sec. to 6 sec.)		No. 0 Using $\frac{5}{16}$ R. Drop (6 sec. to 120 sec.) or $1\frac{3}{16}$ R. Drop (0 to 6 sec.)	
Diameter Stock	Hdts.	Diameter Stock	Hdts.	Diameter Stock	Hdts.
0.0 to 0.218	1½	0.0 to 0.203	1½	0.0 to 0.437	1½
0.218 to 0.312	2	0.203 to 0.312	2	0.437 to 0.500	2

Cut off tool 0.062 — 15° = 0.017. Cut off tool 0.093 — 15° = 0.025.

NO. 2

Using ¾ Rad. Drop (90 sec. to 180 sec.)		Using 1 Rad. Drop (6 sec. to 90 sec.)		Using $1\frac{1}{4}$ R. Drop (0 sec. to 6 sec.)	
Diameter Stock	Hdts.	Diameter Stock	Hdts.	Diameter Stock	Hdts.
0.375 to 0.562	1½	0.375 to 0.562	1½	0.375 to 0.562	1½
0.562 to 1.125	2	0.562 to 1.093	2	0.562 to 1.00	2
1.125 to 1.312	2½	1.093 to 1.312	2½	1.00 to 1.25	2½

CUT OFF TOOL

Diameter stock 0.375 to 0.562 = 0.093 — 15° = 0.034.
Diameter stock 0.562 to 1.312 = 0.156 — 15° = 0.042.

FIG. 3. TABLE OF CLEARANCES ON SCREW-MACHINE CAMS

made first and with the table it will not be necessary to stop and lay out that part of the cam to obtain the clearance, also there may be some who do not know how to obtain this clearance according to the drop.

Providence, R. I. S. N. BACON.

Natural Rock Asphalt As a Floor Surface

Further to the various comments which have appeared during the last year as to the suitability of concrete or granolithic floor surfaces for machine-shop buildings, and the information given by Mr. Hess re the magnesite floorings used in Germany, some account of natural rock asphalt as a flooring surface may be in order.

This material has been utilized on the European continent for close to a century, though there is also some evidence that it was known and appreciated by the Romans. It is practically a rock which may be melted, poured on a surface and spread to the desired thickness while hot; a few hours afterward is capable of adequately resisting any traffic.

It will adhere to concrete, brick, stone, etc., and can be used on wood if a layer of slater's felt is first nailed to the floor.

It combines a number of excellent qualities, being at once water-tight, dustless, and capable of resisting foot, trolley, or vehicular traffic. It is a bad conductor of heat, thus, when laid on concrete floors eliminates the trouble due to the concrete drawing the body heat from the lower extremities of persons working in the rooms. Being impervious to water it makes an excellent covering for flat roofs. Such roofs are, as a matter of fact, by its use, often adapted to act as water cisterns either for fire protection, or to keep a more equable temperature in the top stories of buildings. Its practical freedom from dust makes it an ideal floor covering for many manufacturing purposes.

The owners of textile and dyeing plants for instance are appreciating this feature. As an electrical insulator it is equal to vulcanized fiber; as a vertical or horizontal damp course for the foundations of buildings it is unequaled, and when laid on a concrete foundation it forms a perfect roadway, owing to its being jointless and impermeable, thus allowing of proper drainage with a minimum of curvature in the cross-section of the road, at the same time it does not absorb excreta and can easily be flushed.

Its only drawback, from the machine shop point of view, is that it will not long resist the softening effects of oil, if the oil be left about in pools. It can, however, be easily repaired. It is usefully employed in connection with laboratories, electric storage battery rooms, etc., as it can be adapted to resist acids and alkalies.

Origin, Composition and Manipulation

Regarding the origin, composition and manipulation of the material; natural rock asphalt is a limestone impregnated with bitumen by means—it is supposed—of volcanic or analogous action. The limestone, when geologically in a soft state, is understood to have overlain large deposits of animal or vegetable organic matter. By the tremendous heat present, the carbon was vaporized and forced through the pores of the limestone more thoroughly than can be accomplished by any known artificial means. This feature differentiates natural rock asphalt from artificially manufactured products.

It is converted into "mastic" form at the mines, the lumps of rock being pulverized in disintegrating machines, and the resulting powder cooked for several hours in special furnaces.

The sticky mass is then poured into molds of different shapes, forming blocks weighing about 56 pounds. This is the form in which the material is most frequently exported.

In continental cities and in London it is largely employed, however, in the compressed powder form, for street pavements. The powder is heated in a portable apparatus fitted with fire grate. The heat is not allowed to be great enough to melt the powdered asphalt. The hot powder is then placed in a layer several inches thick and well rammed down on the concrete foundation of the road and finished by smoothing over with hot irons. The latter process vulcanizes the upper surface but the lower portion is still in powder form. The characteristic feature of this application of rock asphalt is that the foot and vehicular traffic afterward constantly keeps up the vulcanizing action, so that the asphalt may wear down to 1 inch or less in thickness and still retain the powder underlayer with vulcanized top surface. This pavement can be used practically as soon as laid. The latter feature and the rapid repairs which can be made commend it for use in the busy central streets of large cities.

For Industrial Purposes

For industrial purposes—covering floors, roofs, etc.—the blocks of "mastic" asphalt are broken up, melted and cooked for some hours in a special apparatus, being stirred all the time either by hand or mechanically. A small percentage of Trinidad bitumen is added during the cooking process to act as a flux. The composition of the bitumen already in the rock and that taken from the Trinidad coke is practically identical. When properly cooked, the asphalt is run off into buckets, laid on the concrete, floor or roof, and spread to the required thickness with wooden spreading tools. Though appearing simple, the operation requires some skill. If required to resist heavy traffic, a proportion of fine, thoroughly dry, granite grit, free from dust, is incorporated during the cooking process.

The usual thickness of the asphalt is about 1 inch and it weighs about 110 pounds per square yard when so laid.

For some purposes it will answer ¾ or even ½ inch thick. When primarily intended for water proofing purposes, it is usually laid in two ⅜- or ½-inch layers. Where horizontal and vertical surfaces meet, as in making a flat roof or a floor watertight, it is advisable to employ an angle fillet of asphalt.

It should be understood that rock asphalt has no great strength in itself, but must be laid on some practically rigid foundation. Natural rock asphalt has a certain resiliency which perhaps explains its remarkable resistance to all classes of traffic. This feature of resiliency is especially appreciated by operatives working in the raw-material mixing departments of textile mills, when lifting armfuls of cotton, etc., from a floor covered with asphalt, they experience a much smaller percentage of worn and torn finger nails and tips than when removing the material from wood or concrete floors.

As regards cost of covering floors, etc., with rock asphalt; in England a roughly approximate price would be $1.08 per square yard for 1-inch thick material, laid on in two ½-inch coats on flat floor or roof work. Vertical work and skirting, etc., cost distinctly more in consequence of the extra labor involved. This price is, of course, modified in either direction according to the area covered; on the European continent I believe prices are somewhat higher.

On the continent it is sometimes employed as a matrix for concrete to form beds for engines, dynamos, etc., on account of its vibration absorbing qualities. For instance, in some of the large champagne storage cellars, the dynamos used for lighting purposes are fixed on such foundations, as any tremor would interfere with the characteristics of the wine. The aggregate for the concrete is prepared much as usual, but is incorporated with a proportion of cooked rock asphalt in place of cement and water. It is advisable to have an upper layer of ordinary concrete so that oil may not be likely to reach the asphalt concrete and soften it.

In conclusion, asphalt is a very loosely used term, but genuine *rock* asphalt is constituted about as follows: Bituminous matter and trace of water, 16.9 per cent.; limestone, 75.6; insoluble sandy matter, 7.5 per cent.

In its purest form, the bitumen is approximately: Carbon, 84.5 per cent.; hydrogen, 12.5; oxygen, 3 per cent.

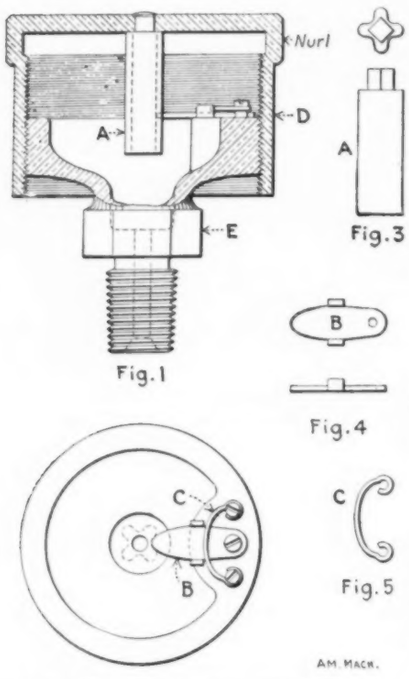
JAMES VOSE.

Manchester, England.

Grease Cup for Vibrating Machinery

Fig. 1 shows a sectional view of the cup. Fig. 2 is a top view of the base *E* and shows the double ratchet arrangement which takes care of all jars.

In Fig. 3 is shown a cast-brass piece which is riveted to the top cap *D*. Fig. 4 shows a small sheet-brass piece which is



GREASE CUP FOR VIBRATING MACHINERY

pivoted and held in place by a small screw in the base *E*. This piece has small projections on either side to engage the curved spring shown in Fig. 5. This spring is bent to the shape shown and fastened to *E* by means of two small screws. Thus it will be readily seen that when turning the cap *D* in either direction one of the small prongs on *B* will engage the spring *C* and force it in the opposite direction, thus forming a double ratchet.

This construction I am confident will overcome all trouble and will give far more satisfaction than the ordinary two-piece cup. EDWARD SOBOLEWSKI.

Cincinnati, Ohio.

To Keep Oil Stones Sharp

A good method to keep the corners of India oil stones sharp and the surface of the stone flat is to have at hand a planed cast-iron plate on which to true the stone by sprinkling powdered carborundum over the surface of the plate, and lapping or rubbing the stone to a flat surface.

This rapidly trues the stone and also sharpens it and improves its cutting qualities by the fact that it becomes charged with carborundum which is forced into the pores of the stone.

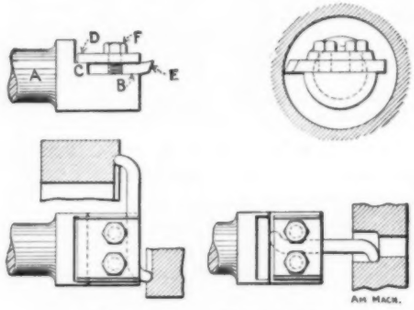
A harder stone may be used when it is kept sharp with carborundum than is otherwise the case.

Philadelphia, Penn. J. H. HARRIS.

Boring and Facing Tool

Having a great deal of boring and facing to do in a small shop, which was not very well equipped with small tools, I made the following tool to use on the milling machine.

I took a piece of round, cold-rolled stock 1¼ inches in diameter and 6



A BORING AND FACING TOOL

inches long, and turned 4 inches at *A* to fit the body of the milling-machine chuck. The large end I milled at *B* to center, 1¼ inches from the end; I also milled a shoulder 5/16 inch high and 5/16 inch back at *C*, to support the tool clamp *D*. I then made two plates ¼ inch thick; one 1½x1½ inches, the other 1½x1⅛ inches, with which to clamp the cutting tool *E* to the body of the holder. I used two 5/16-inch cap screws *F* through the clamp and 5/16 inch square high-speed steel for cutters.

The illustration shows the assembly of the tool and the different ways in which it can be used; both in large and small boring and facing.

It is very convenient in facing, as the cutter can be set at almost any angle and at whatever radius required, often saving the price of a cutter for special work.

W. T. STMDWICK.

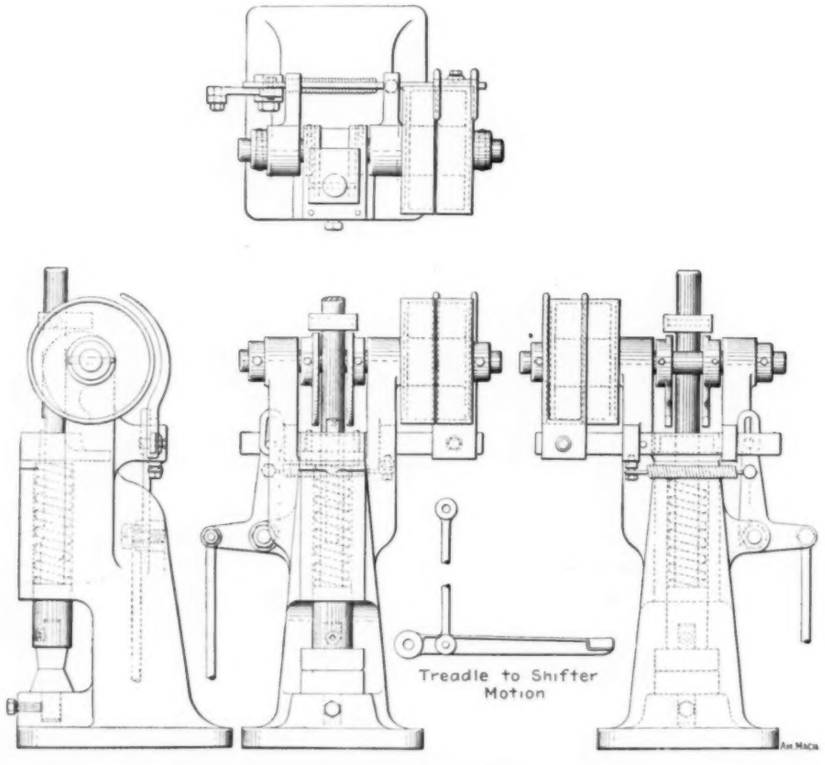
Minneapolis, Minn.

A Power Driven Spring Hammer

The line cut shows a hammer, which we built to replace hand work. It had fast and loose pulleys, the belt being normally on the loose pulley, retained there by the spring. The belt shifter is worked by a treadle which, when depressed, shifts the belt to the fast pulley. When the pressure is relieved the spring returns the belt to the loose pulley. The hammer was built for special work, but was found to be generally useful.

J. P. VARLEY.

Manchester, England.



A SPRING HAMMER

Clamping Tool Slides

An important element in the high-duty operation of the modern machine tool is a proper method of clamping the tool slides and allowing an exact free movement of the slide on release of the clamping screw, a condition lacking in many modern machine tools; in fact there is but little improvement over the method used a quarter of a century ago. Cheap thin gibs of cast iron or steel are still used and with small setscrews. Fig. 1 shows common types on alleged modern machine tools. Fig. 2 shows what sometimes happens with thin cast-iron gibs or brass ones; the clamping screws will gradually find their way clear through the gib and badly injure the slide beneath.

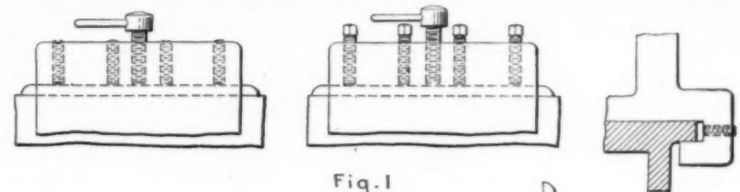


Fig. 1

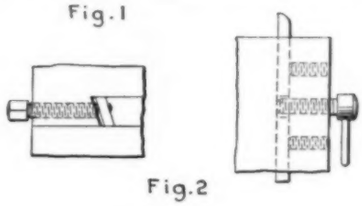


Fig. 2

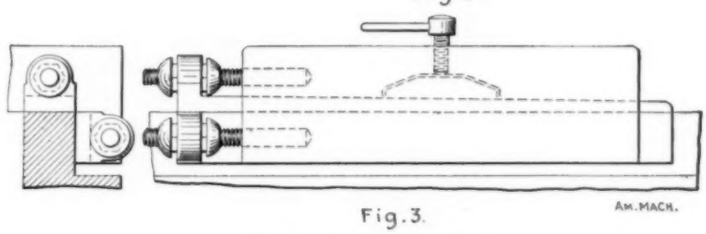


Fig. 3.

CLAMPING TOOL SLIDES

The slotted and square head screw and straight gib should be entirely discarded for a new and more modern detail.

Fig. 3 shows an improved detail of gib. The idea is, to have an experienced man adjust the gibs on all machine tools and to forbid any alteration, a possibility only with a new and modern detail and the entire discarding of the crude gibs now used.

Brighton, Mass. F. RATTEK.

Edging Die for Rectangular Brass Piece

The part being edged is a rectangular brass piece, about 4 inches wide and 7 inches long, each end of which was curved, before edging, as shown in Fig. 1.

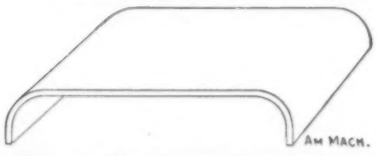


FIG. 1. THE BRASS PIECE EDGED

The die comprises a cast-iron base *A*, Fig. 2, the upper projection of which is machined to receive the hardened-steel wedge-block *T*, secured by three screws and two dowels, and also by a shoulder against *A* to absorb the thrust.

Two shoulder-screws *N*, sliding vertically in casting *A* and actuated by the two helical springs *M*, carry the gage bar *P* of hardened tool steel. Screw plugs *L* retain the springs *M* in their pockets. Two other shoulder-screws *K* limit the travel of the hardened tool-steel anvil bar *F*, which carries the forming ribbon bar *G* also of hardened steel at its upper right-hand edge.

Three strong helical springs hold this bar *F* in its upward position even against the action of the springs *D* in the upper member *E*.

A front retaining plate *H* of soft steel guides the bar *F*.

The punch or upper part of the tool consists of a cast-iron carrier *B*, to the lower face of which is held the folding slide *O* by means of the shoulder-screw *U* working in the elongated slot in the hardened tool-steel slide *D*. Two tail rods *R* sliding in the hardened-steel bushings *Q* and actuated by the rubber buttons *S* return the slide *O* to a right-hand location as the upper members rise.

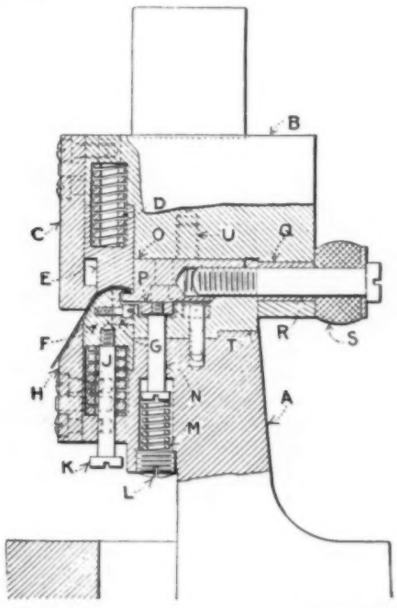
A pinching bar *E* of hardened tool steel operates in a slot in *B*. Its downward travel is limited by the front plate *C*. Two helical springs press the bar *E* downward.

The die is shown in the extreme down position. The lower edges of plate *C* and bar *E* conform with the curve on the end of the piece, and the anvil bar *F*.

When the die is open, the pinch bar *E* is in a down-position and the folding slide is over to the right. The anvil bar *F* is in extreme up-position, as is also the gage bar *P*.

The brass piece is laid over the bar *F* until its edge touches the gage bar. As the press is tripped and the upper members descend, the work is first pinched by the bar *E* on bar *F*; then the springs *D* begin to compress, being much weaker than springs *J*. The folding slide descends and bends the edge of the piece down at 90 degrees before it hits the wedge part of *T*. At this moment, the bar *E* has "bottomed" against *B* and the anvil bar is forced to descend with the upper parts. This allows the slide *O* to be wedged over to the left by *T* and thus fold the edge of the piece back under the ribbon bar *G*, completing the bend. The gage bar *P*, of course, disappears during this operation.

As the punch ascends, these actions are all reversed and the die opens, leav-



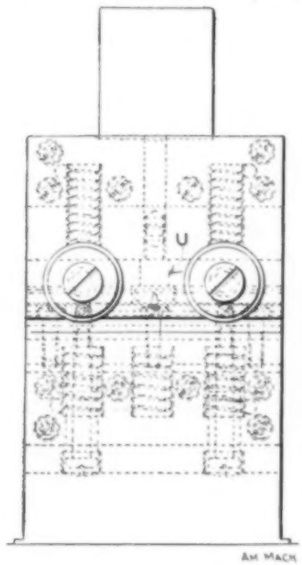


FIG. 2. THE DIE

ing the work edged over the anvil bar, from which it is easily removed. Any tendency of the piece to tilt on account of folding down in the first part of the operation, is counteracted by the ironing action of the lower face of plate *C*, which brings it promptly back to shape.

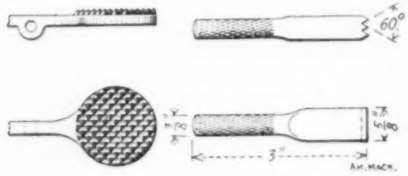
The tool is clean, safe in operation, and entirely practicable in its design.

Detroit, Mich. ARON LAWRENCE.

A Handy Checkering and Nurling Tool

The usual way of checkering a small, flat piece, such as the finger latch, shown at the left in the accompanying cut, is to take parallel grooves across the surface with a triangular file. It is difficult to get even spacing and straight lines by this method, and a preferable way is to use a tool such as shown at the right.

This tool has three teeth cut on one end and is shaped at the other so as to be easily held in the hand and struck with a hammer. Light cuts are first made in both



HANDY NURLING TOOL

directions, to space off the teeth, and the work is then gone over again, until the lines are raised to the desired hight. Even spacing is assured by using a three-tool tool, and the lines will be be straight if the last cut is used as a guide for the next.

Providence, R. I. TOOLMAKER.

Wanted: Some Simple Qualitative Tests for Steels

I believe there are a considerable number of machine-shop owners and machinists as well who are getting all balled up on the tool-steel situation. I know we are and I take the liberty of asking if there is anyone who will advise us if they have listed the various steels now on the market and have them scheduled in a manner that their various virtues may be distinguished by common machinists. I remember along in 1880 most all of us had such available material listed as to its qualities at our finger tips. If we ordered machine steel we got a steel that we knew would make dandy spindles; now if we order machine steel we are liable to get anything from soft shafting up.

We had three or four brands of tool steel. No one ever expected to receive a tool steel of any kind that had been previously annealed and as we were limited to brands, we got to know pretty well just how they must be handled to get temper into them, and what their limitations were when so tempered, but the old sheet-iron lime box seems to be a thing of the past, and we get our steel already annealed from the stock houses. Convenient as it ought to be, I feel safe in assuming that mighty few of the old machinists work on any of it with any overpowering degree of confidence. Not unfrequently the piece has been reduced to wrought iron and refuses to temper at all. Just how such pieces get out is beyond my means of ascertaining.

Along in the years mentioned came Mushet steel. It took a good many years for the boys to get on to it and when its rugged temper-maintaining qualities resisted all efforts to disqualify it, it finally came to be accepted and all became familiar with its peculiarities. At that time we all thought the limits of steel working had been reached; then came new brands of high-speed steel so fast that it became impossible to assimilate them, so much so that in my opinion the whole steel market is demoralized in the eyes of the machinists.

Our shop is now impregnated with a dozen different brands of so called self-hardening and high-speed steels, all of which seem to require a different method of treatment. Some, if treated by the method advocated by the makers, would cost us a thousand dollars, in gas furnaces, oil baths, pyrometers, chemicals, etc. We find our men's tool drawers littered with pieces of steel, which they use in holders. Each man's knowledge of them has been acquired by trial only, in one way and another, no one else in the shop but he would dare to use them, without expecting to scale the entire gamut of tests for hardness and durability, including a general canvass to ascertain the brand.

TABULATED CHARACTERISTICS OF THE VARIOUS GRADES OF STEEL

Who will deliver us from the confusion which exists in the softer grades as well? We hesitate to order anything any more in the line of metal; old brands have changed names, new brands have unknown qualities, new metals with unheard of qualities are on the market. We ordered a short time ago some of the old time composite steel, tool steel welded on a wrought-iron base. We received it all right, but our toolmaker couldn't tell the tool-steel face from the soft-steel face, with the result that the cutting edge was made on the soft-steel face, and the die ruined. Ordinarily the wrought face is at once noticed on account of the seams, but in this case the soft side was as clean as the hard side, and being annealed, one side was about as soft as the other; in fact the mild-steel side was the harder, on account of which the toolmaker fell into error. We ordered three times from the stock-house sheet-steel strips saw temper and ground flat. Each time we received ordinary flat steel cut to dimensions, and finally we got the stock from a saw firm in Philadelphia.

We are in constant fear that we will not receive the goods we want. We are now in the market for some drawn-steel tubes 4 inches diameter, $\frac{7}{8}$-inch wall, the material shall be equivalent in hardness to spindle crucible steel. The makers are uncertain how hard this is, as spindle steels are made under different specifications for carbon content and so on and so forth.

Now the question is, will someone step forth and indicate a plan whereby the whole metal situation can be grasped by the shop owner and machinist as to what it contains, what it is good for, and how it may be ordered, something about grades, etc. For instance we hear about open-hearth and coke steels, vanadium, tungsten, titanium, high carbons, and low carbons. It would be very convenient indeed if we could get access to some standard metal scale which would indicate characteristics, quality, hardness, etc. I have no doubt that other shops are experiencing the same conditions that we are.

L. C. SHARP.

Plattsmouth, Nebraska.

When concrete floors have been chipped in particular places because of some phase of the industry which gave rise to dropping heavy materials in one place, the proper method of repairing is to chip out with mallet and chisel a recess usually square, of sufficient depth to reach to the bottom of the deepest break in the concrete surface. The rough surface resulting from this process is then treated with acid to bring out the solid aggregate, or else a stiff brush is used to remove all the loose dust, and the recess washed out by sluicing with a hose. When all the dust particles have been removed the recess is grouted with cement and before this has set the granolithic finish applied and leveled with the rest of the floor. Repairs made in this manner, according to the *Cement Age*, are just as permanent as the remainder of the floor, as the bond between the new and old concrete will be perfect if all the loose material has been carefully removed.

Statistics show that the percentage of boiler explosions is less than that of flywheels, and that the average loss ratio on flywheels is more than twice the average loss ratio on steam boilers. A boiler explosion makes lots of noise and a flywheel goes to pieces without very much disturbance. A column will be given to the boiler accidents in the newspaper, but a few inches will generally serve for the flywheel accidents, even though the loss may be several times greater than that caused by the boiler.

Safety in Oxyacetylene Installations*

By Edwin H. White

Fundamental principles of acetylene, which, when understood, make the handling of gas a simple and safe proposition.

A decided difference between liquid acetylene and dissolved, which is often a confusing statement.

*Copyrighted by E. H. White, 1911.

It cannot be too clearly understood that acetylene must in no manner be compared with gunpowder, dynamite, etc., for these are true explosives, not requiring air for their reaction from solid to gaseous state. Acetylene in the absence of air or oxygen is not explosive and will not ignite. Calcium carbide, the solid from which acetylene gas is evolved, is an inert substance. It can be pounded with a hammer until reduced to an impalpable powder without result. Calcium carbide is a compound of lime and carbon. Brought in contact with water (H_2O), acetylene gas (C_2H_2) is evolved by reason of the affinity between calcium and oxygen and between carbon and hydrogen. As a result we have a hydrocarbon gas, called acetylene, and a residue of slacked lime. Acetylene, in common with all hydrocarbon gases (such as city gas and gasolene vapor), must first be mixed with air and a naked flame applied before ignition can take place.

Generating Acetylene

The lower cost and greater reliability of supply when acetylene is automatically generated on the premises are advantages that make generators a necessity if much work is to be done—a necessity more than ever apparent in view of the fact that generators are to be had in all sizes and one unit will supply an entire shop at an expenditure of time not exceeding one hour per day spent in cleaning and recharging with calcium carbide and water. Probably 90 per cent. of all oxyacetylene installations in the United States employ generators. Hence, the safety factors involved in such employment should be considered.

There are two ways of generating acetylene. One is to drop carbide automatically, a little at a time, into a relatively large body of water; the other is to feed water automatically in limited quantities upon a relatively large body of carbide.

The authority (Lewes) quoted in previous articles, shows that in the last mentioned type, commonly known as water feed, from 400 to 700 degrees Centigrade temperature is nearly always reached during generation. Often, on withdrawing the carbide container from a generator of this type I have found the carbide being acted upon at a glowing red heat. It is obvious that there is a danger inherent in the employment of a generator of this type, in that the temperature of the carbide may, during generation, be above the ignition point of acetylene and air mixtures. No generator can be recharged without admitting some air. This air mixes with the gas on the first evolution of the latter.

In comparison, the other type of generator known as carbide feed accomplishes cool generation. The actual temperature may be closely figured. A pound of commercial carbide contains 750.7 B.t.u., and a gallon of water weighs 8.33 pounds, each B.t.u. raising each pound one degree Fahrenheit above the temperature of the water before generation starts, which is, usually, from 50 to 70 degrees Fahrenheit. The reader will observe that in the carbide-feed type of generator the proportion of water to carbide is one gallon to the pound; that is, a generator holding 50 pounds of carbide at a charge will also hold 50 gallons of water.

A serious objection raised against the employment of water-feed generators is the condition of the residue, which it is not safe to discharge into the sewer.

The high temperature resulting from generation in this type of machine causes a baking on (in parts of the mass of carbide) of the residual lime, so that the supposed spent charge of carbide really contains kernels of good carbide with lime baked on the outside. On being deposited in the sewer, the lime gradually dissolves off, in which event there takes place the generation of acetylene gas in the sewer. This has been so well determined that the National Board of Fire Underwriters and local authorities in many localities will not permit the disposal of such residue in drains.

Many means have been devised by many inventors for dissipating the heat of generation in water-feed machines; i.e., conducting heat away from the carbide compartment. All of these attempts, at making a seeming wrong principle right overlook the fact that carbide is a poor conductor of heat. A piece of carbide can be held in a flame until the end of it is red hot; the other end will not become hot enough to be really uncomfortable. Thus, a water-jacketed machine on the outside may be perfectly cool to the hand, while generation is going on in the center of the carbide being acted upon, at a temperature of several hundred degrees Centigrade.

The above data assume that the water-feed generator is being drawn upon for gas at the rate of one-half cubic foot of gas per hour from each pound of carbide contained in the generator, and the data on the carbide-feed principle assume that the generator is being run at double that, or one cubic foot of gas per hour per pound of carbide contained in the carbide holder.

One cubic foot of gas per pound per hour, as above stated, is the rating of the National Board of Fire Underwriters for acetylene generators of the carbide to water type and one-half that amount is the rating given to water-feed generators.

In any type of acetylene generator, the gas must be vented off, generators being provided with a vent for this purpose. In the water-feed generator, this vent is necessary in order that the gas contained in the machine will not come into the room when the carbide container is taken out for replenishing. In the carbide-feed type of generator, the vent is necessary in order that air may enter the machine to cause the displacement of the water in the tank.

It is important that users of acetylene generators clearly understand that acetylene gas is almost as heavy as air and hence, when the generator is vented to atmospheric pressure, the gas remaining in the machine moves very slowly. It is a common mistake on the part of operators to think that when they have opened the vent of the machine they have vented out all of the gas contained in it. This error in judgment has led to accidents, for it is human to peer into the interior of the generator and to employ a match to aid vision. The point is, that when the generator vent was opened and the gas pressure reduced to atmosphere, some air entered the machine, enough to make an explosive mixture were a naked flame applied. The match above referred to furnishes this. According to the rules of the National Board of Fire Underwriters, generators must be so placed that the attention required can be fully performed without need for artificial light.

One question of safety in the operation of acetylene generators on which too much emphasis has been laid, is that of pressure.

As pointed out in the previous article, acetylene, from the standpoint of pressure, is not in any sense hazardous

unless it be a pressure at the liquifying point of acetylene or an operating pressure exceeding thirty pounds.

Since the liquifying point of acetylene is four hundred pounds pressure per square inch at freezing temperature, it is obvious that this point can never be reached in an acetylene generator, for the good and sufficient reason that long before such a pressure were reached, the generator would be torn apart, no generator being made to withstand an ultimate of greater than two hundred pounds per square inch.

There are two very good reasons why generators do not operate at greater than thirty pounds gage; one is that every good generator is provided with a positive-acting relief valve which actuates at fifteen pounds, venting the gas out of doors; another is the fact that if there is more than eleven pounds pressure in the pipe line the operators of torches cannot keep them lighted, for the velocity of the gas, at above eleven pounds, is greater than the speed of ignition. In other words, a pressure exceeding eleven pounds blows the largest torch out.

Fool Proofing

In the final analysis, the safety of an acetylene generator depends upon making carelessness, forgetfulness, and evasion of proper use of the machine impossible.

This is important if for only one reason, viz., the fact that the man usually in charge of the generator may at some time not be on hand and the replenishing of it with carbide and water left to one who does not understand it.

All acetylene generators have an outside opening for introducing carbide into the carbide container, a water inlet pipe and valve, an overflow pipe and valve, and an outlet or gate for discharging the residue or slacked lime.

It is important that every one of these connections be closed in their proper order after having been used. In generator construction they should be so interconnected as to make this closing a condition to putting the generator into operation.

If, for instance, everything but the cover to the carbide container is closed, and the machine can be put in operation, there would be escape of gas into the generator room. Means should therefore be provided, making it impossible to start the machine until the carbide cover has been put on and made absolutely gas tight. It is equally important that before the machine can be put in operation it be necessary for the operator to shut off the water when the proper level has been established. If the construction permits him to forget shutting off the water, the water level can gradually rise until it reaches the carbide container, which would cause a sudden generation of gas sufficient perhaps to burst the machine. The flush-out gate should be so designed that the operator must close it tightly before the machine can be put into operation, for if he can forget to do that the water can gradually leak away; if there is not sufficient of it after a time to absorb the heat of generation, hot and impure gas would result and an undesirably high temperature would be attained. It is, of course, obvious that the overflow pipe which establishes the water level in the generator, should be automatically closed, for otherwise gas could escape into the room on operation of the machine.

The above general specifications are fully met in many types of generators, but there are in addition two others which the purchaser should insist upon in the construction of any machine he would seriously consider. A condition to starting operation of the generator shall be that it cannot be started unless the residue has been removed and fresh water admitted to the proper water level. This is easily accomplished by so constructing the relation of the different parts as to make it necessary to lift the flush-out gate before the cover of the carbide container can be taken off. Thus, the residue must be let out, else carbide cannot be put in.

The actuating of the machine subsequent to filling the carbide container should be dependent upon a fixed relation between the water level required and the operating mechanism for this reason: It is a temptation to an operator to run two or more charges of carbide through one charge of water. This means that the residue of slacked lime gets so thick that the carbide as fed will not after a time sink into the pudding as it most properly may be termed. Consequently, the carbide keeps feeding until a large amount accumulates. Getting heavy enough it suddenly sinks into the pudding. There is then a sudden generation of a large volume of gas and perhaps a bursting of the machine.

I appreciate that in going over these various safety factors, the reader may feel that the employment of a generator is a hazardous undertaking. So is the employment of anything that performs useful service if it is not designed by people of competent training who have conscience in manufacture.

Extraordinary Drilling Records

The possibilities of the drilling problems seem to grow from year to year, the latest data on the subject being from the tests made at the Atlantic City convention of the Railway Master Mechanics' Association by the Cleveland Twist Drill Company. The results are shown in the accompanying table:

The makers do not recommend the extreme speeds as economical, but they were made to see what the drills would stand. Even the maximum of 57½ inches per minute was not the limit of the drill, this rate taking all the current that could be delivered to the motor. This work could only be done under ideal conditions of holding work, rigidity of the machine, perfect grinding and expert handling, and the chief value is in showing the strength of drills.

The tests were conducted on the Foote-Burt high-duty driller.

Size and Kind of Drill	Material	R.p.m.	Feed per Revolution	Inches Drilled per Minute	Peripheral Speed in Feet per Minute	Cubic Inches Metal Removed per Minute
1¼" Paragon	Cast Iron 3½" Thick	500	0.050	25	163.6	30.68
1¼" Paragon		325	0.100	32½	106	39.88
1¼" Paragon		475	0.100	47½	155	58.29
1¼" Paragon		575	0.100	57½*	188	70.56
1¼" Paragon		300	0.030	9	117	15.90
1¼" Paragon		325	0.100	32½	127.6	57.43
1¼" Paragon		335	0.100	33½	131.5	59.19
1¼" Paragon		355	0.100	35½	139.4	62.73
1¼" Paragon		235	0.100	23½	107.6	56.52
1¼" Paragon		350	0.100	35	160	84.19
2⅜" Paragon		190	0.050	9½	115	39.90
3" Paragon		120	0.100	12	94	84.82
1¼" Paragon	Machine Steel 4½" Thick	350	0.030	10½	113.7	12.88
1¼" Paragon		225	0.040	9	94.8	18.66
2⅜" Paragon		165	0.020	3¼	100	13.65
2⅜" Paragon		200	0.020	4	121	16.80
2⅜" Milled		150	0.015	2¼	98	11.04
2⅜" Milled		150	0.040	6	98	29.45
2⅜" Milled		175	0.040	7	114.5	34.36
1¼" Paragon		275	0.030	8¼	125	19.84
3" Paragon		150	0.030	4½	117.8	31.81
3¼" Paragon		150	0.030	4½	127	37.33

*Highest drilling speed on record.

COMPLETE OFFICIAL RECORD OF THE TESTS

It is reported that the following is a successful method for drilling glass or springs: Take the small sprues from iron castings which run through the holes in the mold made by the molder with a small wire for vent holes for the escape of gas, and grind to the shape of a flat drill. These pieces of cast iron of small diameter are exceptionally hard, and materials too hard to drill with a steel drill hardened by the time-honored methods, can be readily drilled by them.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For July,* 1911 *(American weekly, American monthly, English weekly and German weekly), total,* 111,250.

Of this issue 29,750.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 213

American Machinist

Aim of Shop Management

The aim of shop management should be to establish just conditions on the one hand for every employee and on the other hand for the employer. This is putting into effect the spirit of the best of modern business; that is, from every business transaction both parties thereto must be the gainer. This is directly opposed to the old spirit of trading, where one party was expected to be cheated or at least put at a disadvantage.

This statement of the aim of effective management must not be thought to imply that present managements are deliberately unjust. This is not the case. But the basis of the relationship between employer and worker has been so ill defined that the final result in far too many cases has been one of injustice, sometimes to one party, sometimes to the other.

A reason for this condition lies in the fact that heretofore there has been far too little attention paid to the question of contract between employee and employer. There has not been a clear understanding of what the worker was to give in thought and labor, and produce in marketable product, nor what the employer was to furnish as work and working conditions. Wages can hardly be put in this list, for they have usually been definitely agreed upon between the contracting parties and have been the only thing so determined.

The development of the spirit of perfect justice will establish definitely the provisions of the agreement between employees and employers, though not necessarily in the form of a written contract. The indefinite statement "a fair day's work for a fair day's pay" will be banished and in its place will be a bargain for a certain amount of product having a given market value in exchange for a certain wage; all this on a just business basis.

Two great studies will contribute to this system of shop management which is now growing up, and indeed has been developing for many years. The first is but a continuation of a study begun many years ago, then, and until recently, called the "division of labor." The newer name is "scientific time study." It will determine the just time for turning out a given amount of product.

The second study will be akin to psychology, although we dislike to use that much abused term in referring to it. It will be a study giving useful and usable data in regard to the results upon production and the well being of employees of such features as shop lighting, heating, ventilation, sanitation, rest periods, surroundings and other features of the shop life that have a bearing upon the comfort, contentedness and producing efficiency of employees.

Great possibilities for good are foreshadowed from it. It is both just and humanizing in its purpose. It is as far removed from the intent of making a man or woman an automaton, a mere producing machine, as white is from black.

Overhead Works of Machine Tools

A mechanical engineer who is going through the throes of moving several hundred machine tools from an old plant to a new one, sends us the five following paragraphs in regard to machine drives. They speak eloquently of the troubles that he is encountering.

"On some machine tools, aside from the machine-driving belt proper, I find a separate belt for the feed, for the pump, for the index head, and occasionally for raising the machine head. Often these belts run from two countershafts and frequently from three. What a mechanical mess to contend with!

"The belt from the countershaft must often lead at one certain angle, or at angles within very small limits. This fact has caused me to spend a good many dollars on overhead construction that otherwise might have been saved.

"Frequently where a double countershaft is used, the drives are arranged on opposite sides of the machine. This produces a lovely condition, when you must locate the machine under a crane.

"Counterweights are often arranged to be supported from the roof, a nearby column, or some other part of the building construction. Consider what this means when you are setting tools under a trussed roof that cannot be expected to carry very much additional load.

"Finally, it often looks as though countershafts, counterweights, etc., were simply stuck onto machine tools as afterthoughts, and not considered as integral parts of the design. 'Oh! they can fasten them to the roof anywhere' seems to be the idea. Let us sincerely hope that some day all these detached parts of machine tools will be given as much consideration as the machine itself, and be carefully studied when the design is being developed."

We are quite ready to sympathize with our correspondent and can appreciate some of the difficulties with which he is wrestling. At the same time it must be pointed out that in any machine-tool equipment, which is the accumulation of several years of business, there are older types of tools upon which the details to which he refers have not been as carefully considered as in the best of modern designs. But this qualification is not sufficient to turn in any great degree the force of his remarks. The difficulties of the engineer who plans the location and setting of machine tools, the troubles and scheming of the millwright who puts up the countershafts and overhead gear, and the dangers and bothers of the oilers who attempt to keep everything in good running order, are often too little appreciated by the designer on the drawing board.

With the exception of the last, they are points which may not directly affect the working or output of the machine, but they may have an influence in determining ultimate success or failure. We can hardly expect anyone to be as favorably disposed toward a machine which has caused a lot of difficulty in setting up as toward one which has given no such bother.

In any event, the plea for a more careful consideration of the countershafts, counterweights and other detached parts of machine tools is well founded.

The Plight of the Copyist

A frequently recurring subject is the copying of machines, and particularly of machine tools. In one way we are all copyists to a degree and must always be such; for the greater part of what we do is based upon the knowledge and discoveries that we inherit from the past or receive from our contemporaries. Only a very small part of what we do is original and comes as the result of independent thinking. So in machinery building, the independent forward steps are few compared with the adaptations and reuses of principles and devices that are well known and in the class of common property.

In fact this thought of copying exists in the fundamental principle of our patent law. There we find the requirement that the disclosure of an invention, for the exclusive enjoyment of which the inventor is given a 17-year monopoly, must be made in such a way that others skilled in the art can use the invention after the term of the monopoly has expired.

In this country some are apt to think that others are the sinners when it comes to copying machines. This is an unprofitable question for us to discuss, for it is very doubtful if our skirts are as clean as they might be. We question if there is anyone who has had an extensive experience and acquaintanceship with machinery building who will fail to recall at least one instance where a foreign developed machine has been copied and imitated here. On this particular phase of the subject the less said the better.

But the ultimate effect of copying and the plight of the copyist are worth a moment's consideration. No great industry can be built upon a solid foundation if it is merely imitative and lacking in independent thought. The desire of the copyist is to make money, but he is unwilling to incur the necessary expenditure to develop his article of manufacture. Thus he is always handicapped, for his competitor who does development work is always ahead. And while he too is in business to make money, yet he is willing to pay the price of designing and developing in order to lead in his field.

As one man can copy, so many can copy; and ofttimes the copyists find ruinous competition among themselves. As they are not disposed to have independent thinking done in designing, neither are they disposed to have this same thinking done in the shop; with the result that workmanship deteriorates. This same attitude is reflected throughout the drafting-room force, and while it is possible to copy parts with apparent exactness there are many refined points of fits, clearances, adaptability of materials and the like, which cannot be so copied. This is another cause of deterioration of product.

Thus the plight of the copyist is far from a happy one. With him many of the elements that contribute to final success are wanting. An industry whose members are addicted to this practice is suffering from a tremendous handicap when facing the competition of progressive, independent manufacturers.

New Publications

THE TRADE CONTINUATION SCHOOLS OF MUNICH. Sixty-eight 6x9-inch pages; 7 illustrations in the text. Bulletin No. 14 of the National Society for the Promotion of Industrial Education. 20 West Forty-fourth street, New York City.

This publication is of interest to manufacturers as it gives an outline of the great system of industrial education in force in the Bavarian Capital. There are 46 industrial continuation schools, as shown by the accompanying table, ranging from druggists at the top to student assistants at the bottom. Boys are compelled to attend some one of these schools during the entire period of their apprenticeship, or until their eighteenth year. Employers are required to release them from work for a certain number of hours each week.

In the machinist trade nine hours of instruction are given each week during one day and for four years. The smaller accompanying table shows the subjects taught and the number of hours devoted to each for each year of the course. It will be noted that for the first two years instruction in trade practice occupies but two-ninths of the time, and in the last two years one-third of the time. The scope of the instruction for each subject and course is given in the bulletin.

In addition, the bulletin contains a general introduction by Dr. Georg Kerschensteiner, Director of Education of Munich, in which he discusses the economic, social and educational principles of the system. There are also given the courses of study for four other schools, namely: For the building trade, for printers and type setters, for lithographers and lithographic printers; for joiners and cabinetmakers.

Subjects of Instruction	Hours of Instruction per Week			
	I	II	III	IV
Religion	1	1	1	–
Business composition and reading	1	1	1	–
Arithmetic and bookkeeping	1	1	1	1
Hygiene and civics	1	1		1
Physics	1	1		
Descriptive engineering			1	2
Trade drawing	2	2	2	2
Practical instruction in materials and trade practice	2	2	3	3

HOURS OF INSTRUCTION PER WEEK FOR EACH YEAR OF MACHINISTS' COURSE

A. Commercial Continuation Schools:
1. Druggist, dealers in sundries and dyestuffs.
2. Commercial employees.

B. Trade Continuation Schools:
3. Barbers, hairdressers and wigmakers.
4. Bakers.
5. Workers in the building trades.
6. Bookbinders.
7. Printers and typesetters.
8. Photo-engravers.
9. Decorative painters, lacquerers and gilders.
10. Turners.
11. Fine mechanics.
12. Hotel keepers.
13. Tanners and glove makers.
14. Glaziers and glass, porcelain and enamel painters.
15. Woodcarvers.
16. Jewelers, gold and silver workers.
17. Chimney sweeps.
18. Confectioners and pastry cooks.
19. Coopersmiths.
20. Coachmen.
21. Lithographers and lithographic printers.
22. Machine builders.
23. Machinists, instrument and gun makers.
24. Metal casters, chainmakers, engravers and chasers.
25. Butchers.
26. Photographers.
27. Saddlers and leather workers.
28. Coopers.
29. Lockmakers (building and artistic locks).
30. Blacksmiths.
31. Tailors.
32. Joiners and cabinetmakers.
33. Shoemakers.
34. Tinsmiths, plumbers and sheet-metal workers.
35. Stucco workers and sculptors.
36. Upholsterers and decorators, fringe makers, cord makers and related trades.
37. Potters and oven builders.
38. Watchmakers.
39. Wagonmakers.
40. Tin casters.

C. Agricultural Continuation Schools:
41. Gardeners.

D. Other Continuation Schools:
42. Mechanical dentists.
43. Musicians.
44. Clerks and office assistants.
45. District continuation schools.
46. Continuation school for student assistants.

INDUSTRIAL CONTINUATION SCHOOLS, MUNICH, BAVARIA

Personals

T. W. Guthrie, formerly president of the Republic Iron and Steel Company, has become secretary and general manager of the Standard Welding Company, Cleveland, O.

H. W. Wells, who for a number of years was identified with the International Harvester Company as purchasing agent in charge of purchases of machinery, has been appointed western sales manager for the Windsor Machine Company, Windsor, Vt.

Obituary

Samuel H. Keefer, chief electrical engineer of the Niles-Bement-Pond Company, died on July 19, in Plainfield, N. J., under an operation for appendicitis.

Mr. Keefer had become known in the past few years by his design of a reversing motor planer that this company are putting on the market. He was also the designer of other important electrical improvements in machine tools that are at the present time in the course of development.

Mr. Keefer was a graduate of Stevens Institute with the class of 1906, and then took the special apprentice course with the Niles-Bement-Pond Company. He was but 30 years of age.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Valve Grinder

The accompanying halftones show a grinder recently put on the market by the R. K. Le Blond Machine Tool Company, Cincinnati, Ohio, for grinding the angular seats on automobile valves, which forms a single-purpose machine for the grinding of these parts accurately and rapidly.

The machine shown in Fig. 1 consists essentially of a base column and knee cast in one piece to obtain rigidity. The knee carries a saddle gibbed the entire length, and has a long bearing on the knee. The table slides on a large V and

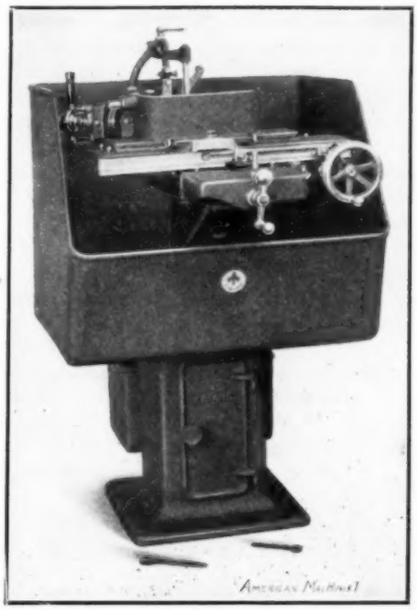


FIG. 1. LE BLOND VALVE GRINDER

is gibbed to the saddle. The upper part of the table carrying the chucking mechanism is arranged to swivel and equipped with micrometer adjustment, so that the accurate setting of the proper angle is easily accomplished.

The chucking mechanism is incorporated in the swiveling part of the table, and consists of a draw-in attachment and collet for holding the work. This allows the valve to be chucked and held close to the part to be ground, relieving the stem from all tendency to spring. The chuck is operated by a lever and the valve can be chucked in an instant after attachment is set. A belt running from the countershaft to a grooved wheel on work spindle revolves the work at any one of three speeds provided. Provision is also made for holding a diamond for truing the wheel.

The grinding head has a hardened-steel spindle and carries a wheel 8 inches in diameter and ½-inch face. The spindle is kept well lubricated by felt pads, drawing their supply of oil from large oil reservoirs. The bearings are protected from dirt, grit and water by felt washers. The adjustment of the spindle is accomplished with one adjusting nut. The wheel spindle has two rates of speed obtained by means of a two-step cone on countershaft.

The cross feed to saddle has a graduated dial reading one-thousandth of an

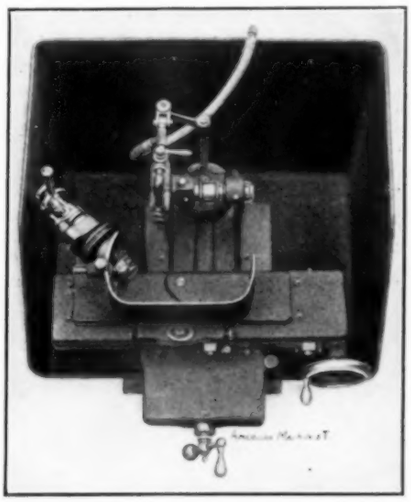


FIG. 2. PLAN VIEW WITH VALVE IN CHUCK

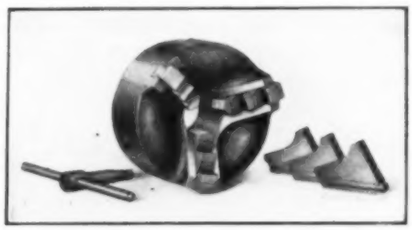
inch, and the table movement is equipped with adjustable stops. The machine shown is arranged for hand feed only, the feed being operated by handwheel on the right of the machine, but when necessary, the machine can be furnished with automatic feed.

The whole upper part of the machine is inclosed in a steel pan to prevent the water from running over the floor.

The water supply is furnished by a vertical centrifugal pump, and the piping and nozzle so arranged as to be swung out of the way when necessary.

A Scroll Chuck

The halftone shows a chuck, made by Schuchardt & Schütte, New York, for externally gripping that class of work, for the scroll chucks are usually considered too weak. The scroll is on an angle and is provided with a thread of the buttress

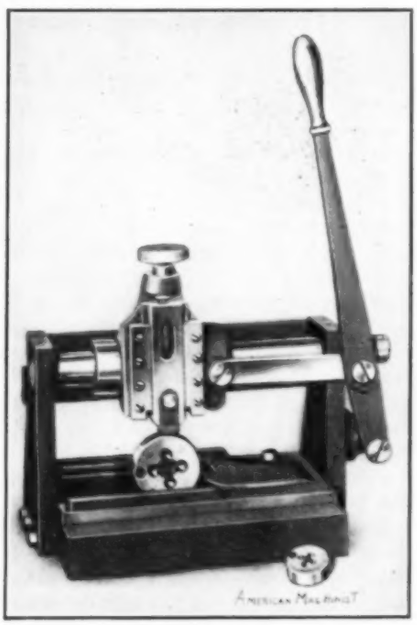


A SCROLL CHUCK FOR HEAVY WORK

type. It is ground after hardening. The jaws slide in angular slots in the body, which covers them so that there is little or no overhang. The chuck will not handle internal work, such as rings.

Marking Machine

The accompanying illustration shows a marking machine, the design and construction of which is immediately apparent from the halftone.



MARKING MACHINE

The head is provided with means for quick vertical adjustment to compensate for varying thicknesses of stock being stamped, and automatic stop to regulate the horizontal movement.

The machine is a recent development of the Remington Tool and Machine Company, Woburn, Mass., and is adapted for straight stamps for round work and circular stamps for flat work.

Electric Furnaces with Replaceable Heating Units

Electric furnaces for annealing, hardening, tempering or coloring metals, are making their way into the machine shops. The special feature of the furnaces shown is the easily replaceable heating units, which make the cost of maintenance very low and avoids delay in case of a break in the conductors, which is bound to happen occasionally in any furnace, even with the best of care, and more often where they are abused.

Each unit is small in section, so as to

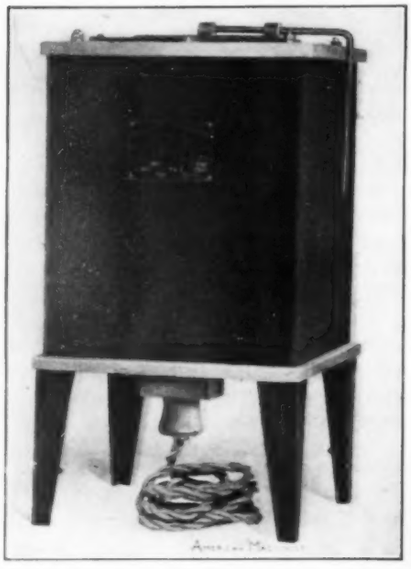


FIG. 1. ELECTRIC FURNACE FOR HEATING LEAD OR CYANIDE BATHS

be easily handled and inexpensive to renew. As many units as desired can be coupled together so as to secure the desired amount of heat.

The unit system of construction is especially well adapted for making special heating appliances or devices to fit into existing machines or other apparatus that requires heat and permits flexibility in its application to varying conditions.

The furnace shown in Fig. 1 is for heating lead or cyanide baths, or for simliar purposes. Fig. 2 is a small self-contained furnace for bench use, a regulating rheostat being contained in the base and controlled by the projecting handle. In this type of furnace there are four heating units, one on each of the four sides, all being easily removable by simply loosening the four nuts shown on the front and removing the units after disconnecting them.

The door is ingeniously hung so as to make a very close joint when closed, and when opened it forms a very convenient shelf for the piece being handled. As the door hangs on trunnions, which rest on an angular slot, it can be very easily removed and replaced at a moment's notice.

Fig. 3 shows a special furnace which will hold a piece three inches in diameter, and 24 inches long on the inside.

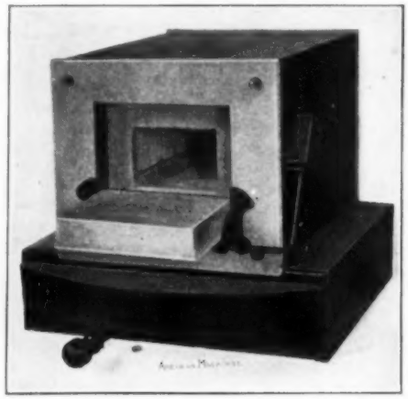


FIG. 2 SMALL SELF-CONTAINED FURNACE FOR BENCH USE

This is designed for hardening long reamers, staybolt hobs, springs, or any similar articles, and can be arranged either horizontally or vertically, as may be desired, and with automatic feed for continuous work.

These heating units are also in sec-

FIG. 3. SPECIAL FURNACE FOR LONG WORK

tions, the same as in the square furnaces, so that they can be easily repaired in case of any burning out at any point.

The furnaces can be equipped with a special two-heat switch, by means of which it is possible to obtain ¼ heat or full heat, and also with special three-heat switches, by means of which ⅓, ⅔ or full heat is obtained, both without the use of a rheostat or external resistance, and with absolute uniformity of temperature. The muffle-type furnaces are also furnished with rear doors and with an opening for a pyrometer when desired.

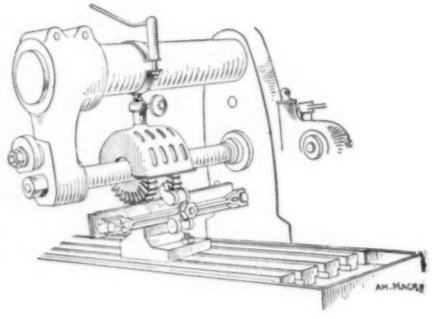
The furnaces give a maximum temperature for a short time of 1900 degrees Fahrenheit, but the safe working temperature is from 1750 to 1850 degrees Fahrenheit. It is well to know, however, that for emergency work, for a short time, a higher temperature can be used, as even in case of a burnout the rewiring of a unit is easily accomplished by sending it to the manufacturer. These furnaces are connected directly on standard light and power circuits of 110 or 220 volts, either direct or alternating current.

The advantage of a system by which units can be easily and economically replaced will appeal to all users of furnaces, especially those who appreciate the fact that the cost of delay due to a furnace being out of commission may be many times more than the actual cost of repairing it. This furnace is made by the Multiple Unit Electric Company, 136 Liberty street, New York.

Milling Cutter Guard

The guard shown in the accompanying line cut is of a design recently developed and manufactured by Alfred Herbert, Ltd., Coventry, England.

As will be noted, its design permits



A LIGHT AND CONVENIENT MILLING-CUTTER GUARD

rapid and convenient application. The shell is made of aluminum and slotted to allow for lubrication and to facilitate inspection of the cutters and work.

Pneumatic Chipping Hammer

The Dayton Pneumatic Tool Company, Dayton, Ohio, has recently placed on the market a new hammer intended primarily for use in steel foundries, having as its special feature an extra-long plunger, permitting a greater bearing surface.

An American Toolmaker in Russia

By Walter F. McColl

During the fall of 1910, there appeared in an issue of the American Machinist an "ad" for a toolmaker to go to St. Petersburg, Russia. Six months later a gentleman called at my home, unannounced and unexpected, asking if I had written the application. The gentleman proved to be the managing director of the Pneumatic Tool Company, St. Petersburg, Russia. I secured the position.

The voyage was very pleasant. The German train, running from Berlin to Eydtkuhnen, was commodious and comfortable, had a good dining car, and made fair time. Few stops were made, but at Eydtkuhnen the train was delayed for about half an hour before crossing the ditch forming the German-Russian boundary at that point, under the eyes of Russian sentinels, to the station at Wirballen, about 500 feet beyond. My passport and baggage were examined within the station. A card of approval permitted me to pass out to a platform from which the train starts for St. Petersburg.

The speed of the Russian trains cannot at all compare with that of the American trains. The gage of the track is much wider. The cars are divided into compartments about 7 feet square, containing two cloth-covered seats, and accommodating comfortably about eight passengers, with room to spare for the dust from the wood-burning locomotive, which accumulates very rapidly. The Pneumatic Tool Company had provided the railways with vacuum cleaners, with which the cars might be cleaned at any time without inconveniencing the passengers, but they are used only at certain stations, apparently very far apart, for the cars were certainly not cleaned between Wirballen and St. Petersburg, 18 hours' journey. In the middle of April, snow banks could be seen along the tracks near St. Petersburg.

At the Warsaw station in St. Petersburg, I was bundled into the manager's automobile. We spent several hours driving around the city to see the sights, and drove finally to the home of the Pneumatic Tool Company, a large brick and tile building located on another of the numerous islands comprising St. Petersburg. The offices front on the street, while the factory extends to the rear about 200 feet.

Remarkable Shop Equipment

In the States, I had read the American Machinist regularly. I had grown to depend upon it, and to look forward each week to the appearance of the issue. Hence, the knowledge of how difficult it would be to secure it in Russia was a little disconcerting. But one of the first things to strike my eye on entering the manager's private office was a line of four piles of the paper, which grows slightly every week. The paper is rather slow in getting here, but on this account is, of course, all the more welcome. It was apparent to me at once that the shop was, as the manager said he tried to make it, only two weeks behind the American standard in equipment, that being the time taken for the American Machinist to reach his office. The shop equipment was quite remarkable in view of the distance of about 5000 miles from New York City, the consequent high freight rate, and the exorbitant duty exacted by Russia on machinery.

The tool room is clean and has plenty of light. There are two Hendey lathes, Kearney & Trecker and Brown & Sharpe universal millers, a Cincinnati grinder, Brown & Sharpe surface grinder, Cataract Optical Company bench lathe, with all its appurtenances, milling attachments, screw-cutting attachments, spring collets, etc., and sensitive drillers; and in the cribs were very ably designed disks, forming tools, etc., connected with the manufacture of pneumatic tools.

In the shop there were Cincinnati, Brown & Sharpe, Kempsmith and Kearney & Trecker millers, Landis, Norton and Cincinnati grinders, Hendey lathes, Warner & Swasey turret lathes, Cleveland automatics, bench lathes, and so on. An American workman, could he walk from his own shop directly into this one, would believe himself to be only in another department; provided, of course, that the Russian workmen were not there, for they would appear a little strange, with their long leather knee boots, with the trousers stuck inside, and their shirts or blouses hanging over the latter. Overalls and aprons are never seen.

A Successful Department

John K. Lencke, manager of the Pneumatic Tool Company, arrived in Russia about twelve years ago, an American citizen who had until then lived in the United States all his life. He was totally ignorant of the language and customs of the Russians. With a very moderate capital he began the manufacture of pneumatic tools, handicapped continually by local conditions that even the thoroughly initiated find it difficult to contend with successfully. Today, his factory, in which he has a majority interest, is one of the largest in St. Petersburg. He has practically a monopoly of the Russian pneumatic-tool business, rendered possible in a large degree by the quality of his products, and his highly competitive prices. These prices are due to the adoption of modern American shop practice in a country with great natural resources, but slightly developed native industries, and commercial conditions analogous to those existing in the United States when the term "infant industries" first appeared.

Of course, in considering the opportunities for the skilled mechanic in Russia, the personal equation cannot be ignored, or the qualities that make for success in a similar enterprise in the United States. The training of inexperienced laborers, entirely ignorant of mechanical work, into men who would earn a good livelihood in a first-class American plant, and increasing their earning power in Russia from 5 copecks or 2½ cents an hour to 40 copecks or 20 cents, quite a high wage, calls for something more definite than a fortuitous combination of circumstances.

The Russian Mechanic

The wages paid the Russian mechanic may appear small and the hours long for a competent man, when compared with the American standard, but his output per day is invariably less than that of the American workman, for the same class and quality of work. Loafing can almost be said to be the rule when the foreman is not present to prevent or detect it. In many factories, the smoking of the Russian cigarette is permitted at all hours of the day. A half hour is allowed every morning and afternoon for refreshments, which consist usually of tea with bread or cake. The relations between the employer and the workmen in his factory are dictated and outlined by national law, which also provides for government inspection in the interests of the workmen. The rights under this law for the workmen at his own option to retain his position two weeks longer, after notice of discharge, encourages largely the arbitrariness of manner with which he does his work.

Vodka, a 40 per cent. solution of alcohol, used as a beverage, and manufactured solely by the government in immense quantities, is drunk freely by the ignorant working class. The government sells it with the provision that it is not to be drunk in the factories, but in most of them the under surfaces of the benches bear many streaks of maroon, long and wide, where the hard wax has been rubbed off the necks of the vodka bottles, so that on vigorous shaking the corks underneath can pop out more freely.

A problem that has always faced labor in the United States, particularly in some parts of the country, is appearing here. A belief is growing with the reading Russian public that the yellow races of the East are a growing menace to the western nations, and especially to Russia, because of its proximity to Asia, and that, in consequence, the present wage scale prevailing in Russia may be lowered materially by the entry of the yellow coolies.

Speeds for Tapping and Threading

EDITORIAL CORRESPONDENCE

When we consider that the tapping of holes is one of the oldest and most common of mechanical operations, it is a little surprising that there is not more information available regarding it.

Inquiry among a number of shops making and using tapping and threading machines, develops a great lack of uniformity in practice and a general haziness in regard to the whole subject. Oil or other cutting lubricant seems to be commonly used on all tapping, including cast iron.

For tapping in cast iron, the F. E. Wells & Son Company, Greenfield, Mass., recommends the following speeds:

¼	⅜	½	¾	¾ inch holes
382	255	191	153	127

using an oil or soda compound.

For soft steel and iron:

¼	⅜	½	⅝	¾ inch holes
229	153	115	91	76

using oil as a lubricant.

The National Machine Company, Hartford, Conn., uses 233 revolutions per minute up to ¼ inch diameter and 140 revolutions per minute for sizes between ¼ and ½ inch, using a screw-cutting oil as a lubricant.

They tap holes as deep as four tap diameters by power.

For threading cast iron in machines of the bolt-cutter type, the Landis Machine Company, Waynesboro, Penn., gives these speeds:

¼	⅜	½	¾	1	1½	2 inches
200	150	125	100	85	55	45

with petroleum as a lubricant. And for soft steel and iron:

¼	⅜	½	¾	1	1½	2 inches
280	220	175	140	115	75	6

with compound or screw-cutting oil, using a 2½-inch belt at 1200 feet per minute.

The speeds are for high-speed steel dies, and users of the machine run at a much higher rate, the figures given being conservative and easily attained.

THREADING PIPE

The Bignall & Keeler Manufacturing Company, Edwardsville, Ill., aims to have its pipe-threading machines run at a cutting speed of 15 feet per minute. The machine for handling pipe from ¼ to 2 inches uses a 3½-inch belt at about 940 feet per minute. They advise nothing but lard oil on the dies.

The Standard Engineering Company, Ellwood City, Penn., also recommends a cutting speed of 15 feet per minute, using a 3-inch belt at 730 feet per minute.

It will be understood in all the cases cited that the figures given are merely a guide as to what can be done and not record performances in any particular. Soft stock can be run very fast, and hard, gritty stock is very hard on the dies.

The only general rule, in the case of dies, is to run as fast as possible without undue heating of the dies.

There is much more to be said on tapping and threading, particularly the former, and it is quite probable that more specific data will be at hand in the near future.

American Society of Engineer Draftsmen

The American Society of Engineer Draftsmen has recently changed its constitution so that the duties of secretary and treasurer will be taken care of by separate officers. Henry L. Sloan, formerly secretary-treasurer, will continue as treasurer; Walter Smyth has been elected to the secretaryship. It is expected by the society that a local branch will be started in St. Louis during September, and shortly after in Pittsburg and Schenectady.

Increasing Shop Capacities

METAL WORKING

NEW ENGLAND

Fire badly damaged the shop of the Highland Machine Company, Roxbury, Mass.

Henry J. Perkins will erect a modern auto garage at Riverside Grove, Springfield, Mass.

The Hart & Cooley Manufacturing Company, New Britain, Conn., manufacturer of metal lockers, etc., will build an addition to its plant.

The Royal Brass Manufacturing Company, Bridgeport, Conn., has organized with $250,000 capital for the manufacture of brass goods. Incorporators, George B. Hedges, Arleigh Pelham and Edmund W. Van Voorhis.

Joseph N. Lapointe, formerly president of the Lapointe Machine Tool Company, Hudson, Mass., has left that ompany and will establish a plant for the manufacture of machine tools in the Longley building, Marlboro, Mass.

Hollander Brothers Company, of Bridgeport, Conn., has been incorporated to make and deal in metal goods, etc. Capital, $10,000. Incorporators, Henry Hollander, Samuel Hollander, Bridgeport; Adolph Hollander, New York City.

MIDDLE STATES

S. D. Schreffler, Cleveland, Ohio, will build a garage.

The New Sharon (Ohio) Motor Company will erect an addition.

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

H. T. Saunders has let contract for a garage at 651 North Broad street, Philadelphia, Penn.

The Havers Motor Car Company, Port Huron, Mich., is planning to enlarge its plant.

The Big Four Railway is building a new roundhouse and small machine shop at Sharon, Ohio.

The plant of the Selik Brothers Tool, Die and Stamping Company, of Detroit, was destroyed by fire.

The plant of the Northern Foundry Company, of Alpena, Mich., was destroyed by fire. Will be rebuilt.

The Michigan Central Railroad Company will remove its shops from Michigan City, Ind., to Niles, Mich.

The William H. Block Company, Indianapolis, Ind., will build a garage in Bird street near Vermont.

The F. B. Stearns Company, automobile manufacturer, is building a new garage and warehouse at Pittsburg, Penn.

T. Gaisel has let contract for a garage to be erected at Ridge avenue and Leverington street, Philadelphia, Penn.

The Atwood Wrench Company, Conneaut, O., has been formed to manufacture pipe wrenches by William Atwood, etc.

The Cleveland (Ohio) Chain factory will erect a plant on A. B. & C. line to be used in the manufacture of chains, etc.

A garage to cost $3000 will be built at 1239 North Twenty-Sixth street, Philadelphia, Penn., for C. W. Young & Company.

The Ingersoll-Rand Company has started work on a new plant at Phillipsburg, N. J., for the manufacture of the Cameron pumps.

The General Motor Truck Company, of Detroit, Mich., has been incorporated by Thomas Neal, M. J. Murphy, Emory Clark.

A permit has been granted to F. C. Borel, Jr., to build a brick addition to the machine shop at 5123 Sansom street, Philadelphia, Penn.

The Caille Brothers Company, of Detroit, Mich., builders of coin machines and gasolene engines, is erecting an addition to its foundry.

The Canton Grass Clippers Company, of Canton, O., has been incorporated to manufacture clippers by O. Karcher, C. Raspeller, J. Sommer.

The Wolverine Screw Company, of Detroit, Mich., is to move soon into a new building and is planning greatly increased manufacturing facilities.

At Toledo, Ohio, G. S. Mills, Ohio building, is preparing plans for a new plant for the American Can Company to be constructed of brick and concrete.

The Cole Motor Car Company, Indianapolis, Ind., has purchased a factory site in East Washington street, and will erect a four-story factory building.

The Lubin Manufacturing Company has let contract for a garage to cost $5000 to be erected at Indiana avenue and Garnet street, Philadelphia, Penn.

The American Sheet and Tin Plate Company will resume operations at its Aetna-Standard plant, Bridgeport, Ohio, after an idleness of two years.

The Toledo (Ohio) Metal Furniture Company has increased its capital stock and is erecting an addition to its plant to take care of increased business.

The Anderson Electric Car Company, of Detroit, is erecting another addition to its plant which will be devoted to the motor and power plant departments.

The Haberle Crystal Spring Brewing Company, Syracuse, N. Y., is making improvements at its plant at Butternut and McBride streets, including a new garage.

The Twombly Motors Company, 220 East Fifty-First street, New York, will probably locate its new plant in Connecticut. Will build small delivery wagons, etc.

The La France Garage Company, Elmira, N. Y., has been incorporated to operate garage, etc. Capital, $80,000. Incorporators, A. W. La France, C. T. La France, etc.

The Welch Automobile Company, of Detroit, Mich., will move part of its plant to Saginaw, Mich., and combine with the Marquette Automobile Company. Will increase output.

The Eynon Evans Company, machinists, brass founders, etc., has let contract for a three-story addition to its plant at Fifteenth and Clearfield streets, Philadelphia, Penn.

Guarantee Automobile Company, Cincinnati, Ohio, has been organized to operate a sales agency and garage by Joseph Berning, H. C. Wendel, W. H. Jones, etc. Capital, $10,000.

The Cleveland Trolley Wheel Company, Cleveland, Ohio, has been incorporated to manufacture trolley wheels. E. E. Beam, S. L. McAdams, C. M. Hartley, etc., incorporators.

The S. F. K. Steel Barrel Company, Cleveland, Ohio, has been formed with $10,000 capital to manufacture steel barrels by Charles T. Schrimer, J. Merle Finney, Ray H. Kelly, etc.

The Willys-Garford Sales Company, Toledo, Ohio, has been incorporated with $10,000 capital to operate a sales agency and auto garage by John H. Willys, G. H. Bennett, Walter Stewart, etc.

The American Equipment Company, Indianapolis, Ind., has been organized with $50,000 capital to manufacture fire-protection apparatus by M. C. Spearing, H. F. Bykrit and W. F. Roembke.

The Standard Steel Company, of Cleveland, Ohio, makers of polished stove plates, has increased its capital to make enlargements to its plant at Bedford, Ohio. C. R. Williams, general manager.

G. S. Mills, architect, Ohio building, Toledo, Ohio, is preparing plans for another extension to the Willys-Overland Automobile Company's plant, which will be equipped with modern machinery.

Aurora (Ill.) Steel Tank Company has been incorporated with $20,000 capital to operate general boiler shop, machine shop and foundry. Incorporators, Richard Harell, Chas. C. Chabut, O. P. Abell.

The Chicago (Ill.) Octagon Rotary Engine Company has been incorporated to manufacture engines, pumps and accessories. Capital, $100,000. Incorporators, F. J. Ratsch, F. E. Schlin, Geo. F. Leigher.

The Railway and Automobile Grease Cup Company, Terre Haute, Ind., has been incorporated to manufacture grease cups. Capital, $75,000. Incorporators, G. J. Thompson, R. R. Armstrong, O. L. Brown.

The Metallic Flexible Hose Company, Bayonne, N. J., has been incorporated with $15,000 capital to manufacture metallic hose, garment hangers, etc. Incorporators, Aaron Wolf, Leon Sussman, etc.

William Wagnitz and J. L. Van Zile, of Poughkeepsie, N. Y., have been negotiating with the owners of the Milton foundry, which was closed a few months ago, with a view to buying and reopening it.

The Ironton Punch and Shear Company, Ironton, Ohio, which recently took over the business of the Cincinnati Punch and Shear Company, has awarded contract for the erection of a modern factory building.

The Metal Process Company, Cleveland, Ohio, has been organized to manufacture all kinds of metal devices and specialties. Incorporators, J. F. Fagan, W. G. McKitterick, D. W. Dailey, etc. Capital, $10,000.

The Elyria Brass, Iron and Steel Company, Elyria, Ohio, has been incorporated with $50,000 capital to manufacture all kinds of brass, iron and steel articles by J. V. Kennedy, T. J. Whearty, David M. Ryan, etc.

The Eureka Safety Crank Company, New York, has been incorporated to manufacture safety cranks for motors and engines. Capital, $50,000. Incorporators, L. Bartlett, Englewood, N. J.; G. W. Peck, New York, etc.

J. M. Lansden, Jr., formerly connected with the Lansden Truck Company, Newark, N. J., is planning to establish a plant for the manufacture of a new automobile truck. Has opened an office at Orange and Broad streets, Newark.

The American Ordnance Appliances Company, Cincinnati, Ohio, has been organized to manufacture appliances and equipment for ordnance. Incorporators, Al C. Roach, William Dickore, William G. Roach, etc. Capital, $10,000.

The Toledo Manufacturing and Supply Company has been incorporated with $10,000 capital for the purpose of manufacturing plumbers' and steamfitters' supplies and automobile parts by Sigmund Sanger, Trude Wooster, K. A. Kaley, etc.

The A. R. Davis Motor Company, Cleveland, Ohio, has been incorporated with a capital of $10,000 to manufacture and sell automobiles and motor-car parts and accessories, by Charles A. Rolfe, F. H. Grace, George V. Gunderman, etc.

The Northern Ohio Traction and Light Company will soon start the erection of car shops at Kenmore, Ohio, a suburb of Akron. The plant will include new barns and machine shops and the estimated cost of the improvement is about a half-million dollars.

The Maumee Foundry Company, Woodville street, Toledo, Ohio, which has been idle for several years, has passed into the hands of new capitalists and will resume operation at an early date. P. H. Lavin, who will manage the plant, hopes to have things in shape to open early in the fall.

The Ross Heaton Manufacturing Company, of Richmond, Va., has been purchased by Detroit capital and will move to Detroit, Mich., where its business of manufacturing auto top curtain fasteners will be greatly increased. The new company will be known as the Detroit Auto Top Fastener Company.

SOUTHERN STATES

Claude Nolan, Jacksonville, Fla., will erect one-story garage.

The Roberts Motor Company, Jacksonville, Fla., will erect a garage.

The Texas Central Railroad will erect machine shop at Cisco, Tex. H. S. McCall, Waco, Tex., engineers.

The Valdosta, Moultrie & Western Railroad is to build extensive terminals and shops at Valdosta and Moultrie, Ga.

H. Delano, Corpus Christi, Tex., is planning for the erection of an ice plant at Tucson, Ariz. The initial capacity will be 50 tons daily.

The Enamel Brick and Concrete Company, Salt Lake City, Utah, has taken out a permit to erect a new boiler-plant addition to its works.

The plant of the Modesto (Cal.) Creamery was destroyed by fire; machinery entirely destroyed. Loss, about $18,000. The plant will be rebuilt.

The Guaranty Oil Company, Los Angeles, Cal., is planning for the erection of a number of pumping stations between Maricopa and Ventura, Cal.

It is rumored that the shops of the Louisville & Nashville Railroad, now located at Louisville, Ky., will be transferred to Madison, near Nashville, Tenn.

Plans have been completed for new repair shops for the Wheeling (W. Va.) Traction Company. These will be larger than the present shops and strictly modern.

The Swift Motor Car Company, Chase City, Va., has been incorporated with $10,000 capital. Will probably erect garage and repair shop. R. L. Jeffreys, president.

The Beggs Pipe and Foundry Company, Birmingham, Ala., has been incorporated with $50,000 to manufacture iron pipe and other foundry products. Incorporators, H. T. Beggs, R. C. White, etc.

WEST OF THE MISSISSIPPI

Fisher Brothers, of Kenesaw, Neb., will erect a blacksmith shop.

L. Neicken, Portland, Ore., will build a commercial garage and repair plant.

Louis Gerlinger, Portland, Ore., will build a commercial garage and repair plant.

The Great Northern Railroad will build new machine shops at Everett, Wash.

The Chamberlain Machine Works, at Waterloo, Iowa, will erect an addition, 30x80.

The blacksmith shop of Conn Shane was burned at Van Horne, Iowa. Loss, $3000.

J. M. Garrison, Santa Barbara, Cal., has taken out a permit to build a new machine shop.

The Great Northern Railroad is planning for the erection of new shops at Hillyard, Wash.

The Matthews-Davis Tool Company, St. Louis, Mo., is negotiating for a site for a new plant.

B. F. Graybill, Spokane, Wash., will build an addition to his commercial garage and repair plant.

E. F. Parker, Glendale, Cal., has taken out a permit to build a commercial garage and repair plant.

Olvin O. Bowers, of Fargo, N. D., contemplates the erection of a small plant to build road grades.

Babbitt Brothers, Flagstaff, Ariz., will build a commercial garage and automobile machine shop. Plans are being prepared.

The Board of Education, Los Angeles, Cal., will build an addition to its manual arts high school. The building will be fully equipped.

Devery & Sons, Lehi, Utah, has acquired a site and will erect a plant for the manufacture of a patented harvesting machine and specialties.

Clarke Brothers Company, of Belmont, N. Y., building Corliss engines and sawmill machinery, will locate a branch plant in Seattle, Wash.

The Oregon-Washington Railroad and Navigation Company has acquired a site at North Yakima, Wash., and will erect new car shops and repair shops.

The Doubelle Tool Manufacturing Company, Brea, near Whittier, Cal., is planning for the erection of a plant for the manufacture of oil-well tools.

The Backus Automatic Gas Machine Company, Los Angeles, Cal., has been incorporated by Henry Broeker and L. T. Mayo, with a capital stock of $25,000.

The Board of Education, Portland, Ore., will build manual-training buildings at a number of its schools. Plans have been prepared by T. J. Jones, school architect.

Roberts & Co., Salt Lake City, Utah, is at the head of a company which is planning for the erection of a plant in this section for the manufacture of oil-well tools.

The Dunn Manufacturing Company, recently acquiring the plant of the Oxnard (Cal.) Garage and Machine Company, is contemplating the erection of a new foundry.

In connection with its large refinery plant at La Segunda, near Redondo, Cal., the Standard Oil Company, is planning for the erection of machine shops, car shops and carpenter shops.

The Patterson Drill Company, Bakersfield, Cal., is planning for the erection of a plant for the manufacture of a patented oil drill. W. A. Patterson, Brawley, Cal., is head of this company.

Emil Koenig, Upland, Cal., has organized the Upland Foundry and Machine shop, merging his present foundry plant. An addition will be erected to this plant and considerable new machinery installed.

Richard Honey and associates are negotiating for the old plant of the Mexican Car and Foundry Company, at Hutchinson, near the City of Mexico and will establish a plant for the manufacture of steel rails and structural steel.

The Pacific Coast Steel Company, San Francisco, Cal., the Pacific Iron Rolling Mills, Portland, Ore., and the Seattle (Wash.) Steel Company have been merged into one company, the Pacific Coast Steel Company, with headquarters at Seattle. The Portland plant, it is said, will be increased in capacity and machinery for rolling both iron and steel installed. The Seattle plant will be increased in capacity. E. M. Wilson, Seattle, is president of this company.

CANADA

The National Hardware Company, Orillia, Ont., is building an extension to cost $16,000.

The Orillia Plow and Implement Company will build a very large new factory at Orillia, Ont.

Big new roundhouse and machine shops will be built for the G. T. P. Railway at Edson, Alberta.

The London Gas Power Company, of London, Ont., will build a big addition to its gas and gasolene engine factory.

General Manufacturing

NEW ENGLAND

Holyoke, Mass., will extend its water system.

Hardwick, Mass., contemplates extending its water and sewer systems.

The Fuller Holway Company is erecting a grain elevator at Portland, Me.

Geo. H. Clark Company, Meredith, N. H., contemplate installing a boiler.

The city of Springfield, Mass., will install a 12,000,000-gallon pumping engine.

The Bridgeport Elastic Fabric Company, Bridgeport, Conn., will enlarge its plant.

Dover, N. H., contemplates the expenditure of $25,000 in increasing its water supply.

The Fisk Rubber Company, Chicopee Falls, Mass., will erect three additional buildings.

The Salts Textile Company, Bridgeport, Conn., will build a large addition to its plant.

John E. McCarthy, of Springfield, Mass., will erect a new laundry building at that place.

The city of New Bedford, Mass., is asking for bids on two small direct-current generators.

The plant of the St. Albans (Vt.) Cold Storage Company was burned, entailing a loss of $30,000.

The Clarendon Marble Company, Rutland, Vt., contemplate erecting a new mill in the near future.

The Pilgrim Mills, Fall River, Mass., is erecting a weave mill, picker house and power house.

The Union Mills Company, Moosup, Conn., will build a large new weave shed in addition to its plant.

The Berkshire Woolen and Worsted Company, Pittsfield, Mass., contemplate making a three-story addition.

Giron Freres, of St. Etienne, France, manufacturers of velvet ribbons, is to establish a plant in Norwich, Conn.

Worcester, Mass., will increase its water supply. Several centrifugal or electric-driven pumps will be installed.

The Superior Laundry Company, Springfield, Mass., has awarded contract for putting up new laundry building.

The Maine Central Power Company has awarded contract for steam-electric power station house at Farmingdale, Me.

The Standard Oil Company has received a permit for the erection of a pumping house on South Stanley street, New Britain, Conn.

The Worcester Cold Storage and Warehouse Company, Worcester, Mass., will erect two new cold-storage plants at a cost of $47,000.

Leominster, Mass., contemplates the installation of a central lighting and heating plant for all the town buildings, at a cost of $25,000.

The Worcester Polytechnic Institute, Worcester, Mass., has an appropriation for increasing plant and equipment of the hydraulic laboratory.

The New England Telephone and Telegraph Company will expend $12,000 for equipment for the new telephone exchange just completed at Pittsfield, Mass.

The Leominster (Mass.) Electric Light and Power Company will construct coal pockets at its power plant. Other improvements are contemplated at the power house.

The Berkshire Woolen Company, Pittsfield, Mass., expect to erect a three-story addition. It will be used for carding and spinning and will probably cost about $70,000.

Williamsville Buff Manufacturing Company, of Killingly, Conn., has been incorporated to make and deal in muslin goods, etc. Capital, $25,000. Incorporators, H. C. Atwood, C. W. Atwood and H. B. Atwood.

Hambleton Brothers Company, Providence, R. I., has been incorporated with $50,000 capital to manufacture spools, bobbins, shuttles, etc. Incorporators, Geo. Hambleton, F. Hambleton, Goffstown, N. H.; H. A. Baker, Providence.

Pratt Read Player Action Company, of Deep River, Conn., has been incorporated to make and deal in piano players, pianos, etc. Capital, $100,000. Incorporators, Geo. L. Cheney, Essex; W. B. Stevens, Deep River; Adolph Doll, Adolph Doll, Jr., New York City.

MIDDLE STATES

Lucasville, Ohio, will build a waterworks plant.

The town of Pana, Ill., has voted to bond for a $50,000 waterworks.

The Northern Planing Mill, of Au Sable, Mich., was destroyed by fire.

The Pere Marquette Railroad will erect a power house at Saginaw, Mich.

The Mastic Wall Board Company, of Cincinnati, Ohio, is erecting a new plant.

William Johnson, 329 N. Illinois street, Indianapolis, Ind., will install a boiler.

Improvements will be made to the municipal waterworks plant at Andover, Ohio.

The Lambertville Pottery Company, of Lambertville, N. J., will enlarge its plant.

The South Bend Rubber Tire Company, South Bend, Ind., will erect a new factory.

Holden Clay Products Company, Mineral City, Ohio, will make additions to its plant.

City of Akron, Ohio, will erect a new municipal water plant. Mr. Payne, city engineer.

The Western Electric Company will build a $10,000 addition to its works at Hawthorne, Ill.

The plant of the Walher Veneer and Panel Works, at Au Sable, Mich., was destroyed by fire.

The sawmill of the B. Neinemann Lumber Company, at Antigo, Wis., was destroyed by fire.

Bertsch & Co., Cambridge City, Ind., is in the market for traveling cranes for its new plant.

The plant of the Austin Powder Company, Falls Junction, Ohio, was destroyed by an explosion.

American Tobacco Company, Dey street, Jersey City, N. J., will build an addition to its plant.

Midland Linseed Oil Company will build a large plant at Edgewater, N. J., at a cost of $1,000,000.

The plant of the Keystone Box Company, Slatington, Penn., was destroyed by fire. Loss, $40,000.

The city council of Martinsville, Ind., is planning to increase the capacity of the electric-light plant.

The Moench & Sons tannery, Alpena, Mich., which was destroyed by fire recently, will be rebuilt at once.

The boiler shop of the Anderson Foundry and Machine Company was burned, causing a loss of $5000.

The Platten Produce Company, of Green Bay, Wis., will erect a cold-storage plant at Wausaukee, Wis.

Henry Lang, 160 North May street, Chicago, Ill., will build a one-story addition to his machine shop.

The Public Service Company will build a large addition to its power house at Marion, Jersey City, N. J.

Fire destroyed the plant of the Canton Lime and Fertilizer Company, at Howenstine, near Canton, Ohio.

City of Massillon, Ohio, is considering the erection of a new waterworks system. Mr. Yost, city engineer.

The Augusta Silk Works, Paterson, N. J., has let contract for the erection of a four-story mill building.

The Link-Belt Company will put up a two-story addition to its plant at 3905-15 Stewart avenue, Chicago, Ill.

The Pennsylvania Company's grain elevator, at Plymouth, Ind., was destroyed by fire. Loss, $100,000.

The factory of the Union Bag and Paper Company, at Watertown, N. Y., is to be moved to Ballston Spa.

Fire destroyed the plant of the Churchill Cabinet Company, 2119 Churchill street, Chicago, Ill. Loss, $50,000.

The Commonwealth Edison Company will build a $23,000 substation at 3431-33 North Whipple street, Chicago, Ill.

The Ohio Light and Power Company, Tiffen, Ohio, has issued bonds for $1,500,000 to make improvements to equipment.

Fire damaged the Sneipp brewery, 380 East One Hundred and Sixteenth street, Chicago, Ill., to the amount of $20,000.

The Keystone Cement Construction and Manufacturing Company will remove its plant from Waupun to Janesville, Wis.

Work has been started on the erection of a new automobile-body factory, for Hayes Manufacturing Company, Detroit, Mich.

The power house of the Illinois Traction Company, at Riverton, Ill., was wrecked by explosion of a large turbine engine.

The Sisters of Mercy, 1475 Abbott Road, Buffalo, N. Y., will spend $8000 erecting a one-story boiler, engine house and smokestack.

The Geo. H. Strietmann's Sons Company will build an addition to its bakery at Twelfth and Plum streets, Cincinnati, Ohio.

A five-story building will be erected on South Washington square, Philadelphia, Penn., for the Wilmer Atkinson Publishing Company.

The Philadelphia Rapid Transit Company will build a $25,000 power house on Delaware avenue, near Laurel street, Philadelphia, Penn.

The William P. Jungclaus Company, Massachusetts avenue and Bellefountaine street, Indianapolis, Ind., will install a boiler.

The Corcoran Lamp Company, Cincinnati, Ohio, manufacturer of carriage and vehicle lamps, will build a four-story addition to its plant.

The Poughkeepsie (N. Y.) Chair Company has been incorporated to take over the business of William S. Hodge, which will be enlarged.

Eight acres of ground, to be used as a plant site, has been purchased by the Philadelphia (Penn.) Suburban Gas and Electric Company.

The Hulton Dyeing and Finishing Company has let contract for an addition to its plant at Ruth and Tusculum street, Philadelphia, Penn.

The Mack Company will proceed with the rebuilding of the Union Brick plant, at New Cumberland, Ohio, which was destroyed by fire recently.

A permit has been issued to the Philadelphia Rapid Transit Company for the erection of a substation at 1823 East Letterly street, Philadelphia, Penn.

Zimmerman & Co. has let contract for a packing plant, 150x60 feet, at 425 to 429 Fairmont avenue, Philadelphia, and will install a refrigerating plant.

A permit has been issued for an addition to the plant of the R. J. Ederer Thread Company, at Elizabeth and Unity streets, Philadelphia, Penn., to cost $10,000.

The Central Manufacturing Company, Connersville, Ind., furniture manufacturer, is preparing to double its capacity and will add a new building to its present plant.

The Kyoro Pottery Company, of Fredericksburg, Va., has been incorporated to man-ufacture pottery products by W. A. Search, R. W. Spencer, J. C. Scott.

A two-story factory will be built at 2926 Dauphin street, Philadelphia, Penn., for the International Tooth Company, manufacturer of artificial teeth and dental supplies.

The plant of the B. A. Stevens Company, Toledo, Ohio, manufacturer of billiard and pool fixtures and bar-room supplies, was gutted by fire. Loss, about $300,000.

The Batesville (Ind.) Union Furniture Company is enlarging its plant by erecting a four-story brick building. New machinery will be placed in the various departments.

The Pennsylvania Museum and School of Industrial Art has let contract for a boiler and engine house to cost $9500, to be erected at 333 South Fifteenth street, Philadelphia, Penn.

Power-plant equipment will be required for the Northeastern Ohio State Normal School to be erected at Kent, Ohio. Architect Geo F. Hammond, of Cleveland, Ohio, prepared the plans.

The Christian-Schmidt Brewing Company has let contract for a group of buildings, including boiler and engine house, to be erected at Hancock and Edwards streets, Philadelphia, Penn.

The Doddington Company, Columbus, Ohio, has been incorporated with $300,000 capital to operate woodworking factories and lumber yards by E. Doddington, G. E. Richards, O. M. Spencer, etc.

The Cleveland & Youngstown (Ohio) Railroad Company has been incorporated to build an electric line. Capital, $10,000. Incorporators, J. P. Wilson, Fred J. Heim, T. H. Johnson and others.

The Monroe Baking Company, South Bend, Ind., one of the largest baking plants in northern Indiana, has passed into the control of C. J. Gaskill. Mr. Gaskill will enlarge and improve the plant.

The Fink Optical Company, Chicago, Ill., has been organized to manufacture and deal in optical goods and optical machinery. Capital, $25,000. Incorporators, E. J. Fink, H. C. Billig, W. F. Austin, etc.

Power-plant equipment will be required for the 23-story hotel to be erected for the New York Central Railroad at New York City. The hotel will be named the New Amsterdam. Plans have been prepared.

A company represented by James R. Goodrich, of Winchester, Ind., has purchased the electric-light plant at Mitchell, Ind., and will install an uptodate system of waterworks. Work will begin immediately.

The Hoosier Box and Pie Plate Company, Marion, Ind., has been incorporated with a capital of $6000 by Harry A. and M. C. Dwyer, J. J. McCulloch and G. A. Bell, to manufacture paper novelties.

George W. Johanning has purchased the plant of the Batesville (Ind.) Novelty Company. A new company with $25,000 capital will operate the factory after it is remodeled and improvements made to manufacture wooden novelties.

Work has commenced on a new large brewing plant at the corner of Tenth street and Montgomery avenue, Philadelphia, Penn., for the Class & Nachod Brewing Company, to cost $500,000. The plans call for eight buildings, including engine and boiler house and garage.

The Auglaize Power Company, Toledo, Ohio, recently organized, has awarded contract to the Ambursen Hydraulic Construction Company, of Boston, Mass., for a half-million dollar dam and power plant on the Auglaize river, at Defiance, Ohio. Work will be begun at once.

The Hamilton Home Brewing Company will install a plant for the manufacture of artificial ice in connection with its new brewery to be built at Hamilton, Ohio. The capital stock of $100,000 has been subscribed by Max Hemann, Otto Zoller, August Rapp, Frank Kerbel, Louis Morner, *et al.*, and articles of incorporation will be filed in the near future.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., August 22, for bolts and nuts, twist drills, files, steel rivets, machine and wood screws (schedule 3792), rod brass, sheet brass, manganese bronze, Class A bar steel (schedule 3797), billet steel, medium plate steel, black (schedule 3793); August 29, iron melting cupola (schedule 3780).

Bids will be received by the board of trustees of the Athens State Hospital, care the Osborn Engineering Company, Columbus, Ohio, up to August 10, 1911, on two 125-horsepower horizontal tubular boilers complete, one horizontal steam driven air compressor, one air receiver, two air lift wells, etc. Specifications may be obtained of the Osborn Engineering Company.

SOUTHERN STATES

Wm. Adams & Son, Lexington, Ky., are in the market for traveling crane.

The Rockwood (Tenn.) Hosiery Mills will erect an addition for the manufacture of boxes.

The planing mill of the W. B. Mathews Company, Maysville, Ky., was destroyed by a recent fire.

The Reform (Ala.) Ice and Light Company will install electric-light plant. John Newell, manager.

The St. Louis (Mo.) Independent Packing Company has awarded contract for erection of refrigerator building.

The Consumers Ice and Cold Storage Company, Lexington, Ky., will erect an ice, power and lighting plant at a cost of about $200,000.

The South Pittsburg (Tenn.) Light and Power Company will erect temporary building to replace plant recently burned. Will erect permanent plant later.

The Lindloff Piano Company, Wheeling, W. Va., has been organized with $50,000 capital to manufacture musical instruments. Incorporators, C. L. Lindloff, Albert Fiading, J. P. Mersehard, etc.

WEST OF THE MISSISSIPPI

The Abbott ranch, Orange, Cal., will install a new pumping plant.

The Gedney Pickling Company will erect a plant at Mankato, Minn.

The Valley Planing Mill, El Centro, Cal., was destroyed by a cyclone.

The Hemet (Cal.) Canning Association will build an addition to its plant.

The Missouri Candy Company, St. Louis, Mo., will erect a $13,000 addition.

The Marysville (Cal.) Steam Laundry was destroyed by fire. Loss, $15,000.

Loretto Carillo, Nogales, Ariz., is planning for the erection of a new ice plant.

Bonds have been voted for the construction of a waterworks plant at Arthur, Iowa.

The Paradise Creamery Company's plant, at Pray, Mont., was burned. Loss, $7000.

Another alternator is to be installed in the city light and water plant at Waverly, Iowa.

The Los Angeles (Cal.) Gas and Electric Company will build an addition to its gas plant.

The Northern Electric Railway substation, at Marysville, Cal., was partially destroyed by fire.

The Great Falls (Mont.) Electric Company will rebuild its car barns recently destroyed by fire.

The Home Telephone Company, Los Angeles, Cal., will erect a new central station at Venice.

The David Hewes ranch, near Orange, Cal., contemplates the installation of a new pumping plant.

The National Biscuit Company, Los Angeles, Cal., is having plans prepared for a new factory.

The city of Holtville, Cal., has voted bonds for the installation of a municipal waterworks system.

The plant of the D. H. DeCan Shingle Company, at Alki, Wash., was partially destroyed by fire.

The Gaylord ranch, near Wheatland, Cal., contemplates the erection of a large modern creamery plant.

The Belle Plaine Lighting and Power Company will install an electric-light plant at Excelsior, Minn.

W. B. Guitar, Abilene, Tex., is planning for the erection of a cotton-mill plant in the Imperial Valley, Cal.

Bonds for $15,000 have been voted for the construction of a municipal electric-light plant at Minden, Neb.

The Haryson-Otis Milling plant (grain), Tenino, Wash., was destroyed by fire; all machinery was ruined.

The Conradson Machine Company, of Madison, Wis., is planning the erection of a shop to build turret lathes.

The city waterworks, at Oelwein, Iowa, will be enlarged and air lift installed, also a new supply tank built.

The plant of the Valley Laundry Company, El Centro, Cal., including engine room, was demolished by a cyclone.

The Redlands Oil Company, operating at Midway, Cal., is planning to install new rotary drilling equipment.

The Utah Lake Irrigation Company, Lehi, Utah, is planning for the installation of a new pumping machinery.

The Forest Service, Ely, Nev., is planning for the installation of a telephone system in the Spring Valley district.

The Montana Central Elevator (grain), Valier, Mont., will rebuild its plant destroyed by fire a few months ago.

The Mohr & Yoerk Packing Company, Sacramento, Cal., has taken out a permit to build a new packing plant.

The power station of the Siskiyou Electric Company, at Indian Creek, near Fort Jones, Cal., was destroyed by fire.

A. C. Barrett, Portland, Ore., will build a flour milling plant of 250 barrels per day capacity, at Sacramento, Cal.

The city of Albuquerque, N. M., will install a new waterworks system; a pumping plant will be installed in connection.

A franchise has been granted to W. A. Kuntze for the installation of an electric-light plant at Plankinton, S. D.

The University Baking Company, La Jolla, San Diego, Cal., will build an addition to its plant and install new machinery.

The Builders' Brick Company, Seattle, Wash., will build a dry-kiln addition to its plant. Plans have been prepared.

The City Dye Works, Ocean Park, Cal., has taken out a permit to build a new plant. Modern machinery will be installed.

Sherman Smith, Los Angeles, Cal., will erect a new laundry plant on Avenue 35. Modern machinery will be installed.

The dry-kiln plant of the Motor Shingle Mill Company, Seattle, Wash., was destroyed by fire. The plant will be rebuilt.

The American Linen Fibre Company, of Philadelphia, is considering the erection of a fibre-pulp plant at Williston, N. D.

The Tacoma (Wash.) Fir Door Company will build a sawmill addition to its plant. Modern machinery will be installed.

The Los Angeles (Cal.) Bottle and Junk Company has taken out a permit to build a new boiler-room addition to its plant.

Fresno (Cal.) Brewing Company is contemplating additions to its electric generating plant. E. C. Cunningham, chief engineer.

A $60,000 bond issue has been approved by the city of Clarksdale, Miss., for improvements to its municipal electric-light plant.

The Davis (Cal.) State farm has had plans prepared for a new laundry plant and boiler room. Modern equipment will be installed.

The city of Seattle, Wash., is planning to increase the capacity of its power plant at Cedar Lake from 12,000 to 30,000 kilowatts.

The Spokane (Wash.) Soda Bottling Works is planning for the erection of a new bottling plant on Madison street to cost about $30,000.

The Santa Fe Railroad contemplates the installation of new refrigerating machinery in its precooling plant at San Bernardino, Cal.

The Southern California Edison Company, Los Angeles, Cal., has had plans prepared for a large power plant to be erected at Colton, Cal.

The city of Tropico, Cal., is planning to install a new electric street-lighting system. The city engineer is preparing plans and estimates.

The Fresno, Hanford & Summit Lake Railway (electric), Fresno, Cal., will build a new power plant for its proposed interurban system.

The Skagit (Wash.) Power Company contemplates the erection of a new power plant near Marble Mount, Wash. A site has been selected.

The Port Costa Milling Company (grain), San Francisco, Cal., has taken out a permit to build an addition to its plant at Los Angeles.

The J. E. Mitchell Fruit Company, Kerman, Cal., contemplates the erection of a new packing plant. Modern equipment will be installed.

Lundy & Latimer, of Eldora, Iowa, are building a small water power plant near that place. An auxiliary steam plant is also contemplated.

The Northwestern Electric Company, Portland, Ore., recently incorporated, will build a power plant on the Klickitat river, near Lyle, Wash.

Herbert Seaboldt, Salt Lake City, Utah, is planning for the erection of a power plant for mines operation in the Cataract cañon, Colorado river.

The Water Users' Association, Phœnix, Ariz., will build a new power plant at Arizona Falls. C. A. Van der Veer is secretary of this company.

The Junta Gold Mining Company, Telluride, Colo., is planning to install new machinery in its electric power plant; the capacity will be increased.

The city of Pasadena, Cal., has instructed engineer A. L. Sonderegger, Los Angeles, Cal., to prepare plans and estimates for a modern waterworks system.

Joseph Fellows, Wilmington (Los Angeles), Cal., operating a boat-building plant, is planning for the erection of another and larger plant at San Diego.

The Great Western Power Company, San Francisco, Cal., has acquired property near Prattville, Cal., and contemplates the erection of a new power plant.

An ice plant and blacksmith shop will be erected by the Santa Fe, Prescott & Phœnix Railroad, Proscott, Ari., for its Harvey dairy plant at Del Rio, Ariz.

C. E. Fulton and W. W. Woodley, San Pedro (Los Angeles), Cal., are planning for the erection of a new boat-building plant. A site has been acquired.

T. H. Gildersleeve has acquired the plant of the Toledo (Ore.) box factory. An addition will be erected and new machinery for woodworking will be installed.

O. J. Finch, Spokane, Wash., is planning for the erection of a porcelain-manufacturing plant at Millwood, near Spokane. Modern machinery will be installed.

The Northern California Power Company, Sacramento, Cal., is planning for extensions and improvements in its plants and system at Maxwell and Williams, Cal.

The Mainland Brothers, Baker, Ore., are planning for the erection of a 30,000-horsepower plant, near Oxbow, Ore. The capacity of this plant will later be doubeld.

The Chicago and Great Western Railway Company will install another direct-current engine and generator of 400 kilowatts capacity in its shops at Oelwein, Iowa.

The Multnomah Trunk and Bag Company, Portland, Ore., has acquired a site on the Peninsula and will build a new manufacturing plant. About $30,000 will be expended.

The State rock-crushing plant, Selah Gap, near North Yakima, Wash., will install new machinery. K. C. Bowers, assistant State superintendent of quarries, is in charge.

C. S. Purdy, Geyser, Mont., is at the head of a company which plans for the erection of a plant for the manufacture of portland cement. About $1,000,000 will be expended.

Power-plant and cold-storage equipment will be installed in the new Woman's hospital, Los Angeles, Cal. Plans are being prepared. Mrs. A. D. Grove is superintendent.

The Pacific States Telephone and Telegraph Company, San Francisco, Cal., will install a new central plant at Willows, Cal. About $15,000 will be expended upon new equipment.

The city of Santa Monica, Cal., is preparing plans for increasing the capacity of its electro-purification plant of its sewer system from 500,000 to 750,000 gallons capacity, 24 hours.

Power-plant equipment will be required in the new 11-story office building to be erected by the Cobb-Healy Investment Company, Seattle, Wash. About $350,000 will be expended.

The August Oil Company, operating at Midway, Cal., is planning to make extensive improvements in its water system. New boiler and air-compressor equipment will be installed.

The Pacific Telephone and Telegraph Company, San Francisco, Cal., will make improvements and additions in its plant and system at Ventura, Cal. New equipment will be installed.

The entire plant of the Western Mills and Lumber Company, Friday Harbor, Wash., was destroyed by fire. The plant included lumber and shingle mills, box factory and electric-lighting station.

The Alameda (Cal.) Sugar Company contemplates the removal of its sugar-manufacturing plant to a site in the Sacramento valley. The capacity of the present plant, it is said, will be increased.

Col. George McK. Williamson, United States Government, Fort Mason, Cal., will soon ask for bids for the construction of a complete electric-lighting system at the military post, Fort Miley, San Francisco.

The East Sacramento (Cal.) Water Company is planning for improvements and additions in its waterworks and system. Estimated cost, $100,000. H. A. McClelland is president of this company.

The California Consolidated Light and Power Company, San Francisco, Cal., has been incorporated with a capital stock of $5,000,000. C. S. Goodrich, J. F. Piggott, T. E. Palmer, incorporators.

The Sanitary Utilities Company, San Bernardino, Cal., is planning for the erection of a plant for the manufacture of glass churns. Modern machinery will be installed. F. A. Peacock is head of this company.

The Denver (Colo.) Gas and Electric Company, which recently absorbed the Lacombe Electric and the Denver Steam Heating Companies, is to spend several hundred thousand dollars in rebuilding steam-heating plant.

Power-plant equipment will be installed in the new telephone office building of the Pacific Telephone and Telegraph Company, Spokane, Wash. An emergency plant, composed of gas engines, will also be installed.

The Belleplaine Brick and Tile Works will build a plant at Belleplaine, Iowa. One 800-horsepower, one 400-horsepower Corliss engine and one 100-kilowatt alternator will be installed. Estimated cost of plant, $200,000.

The Goodrich Automobile Wheel Company, Stockton, Cal., recently incorporated, is planning for the erection of a plant for the manufacture of a patented wheel. I. L. Goodrich, Sacramento, Cal., is head of this company.

Power-plant equipment will be required for the new addition to be built for the Hotel Alexandria, Los Angeles, Cal. The new addition will be 11 stories and is estimated to cost $2,500,000. Parkinson & Bergstrom, architects, Los Angeles.

The E. K. Wood Lumber Company, San Pedro (Los Angeles), Cal., has acquired a site and will remove its mill and plant to Wilmington, closely adjoining. The capacity of the new plant will be increased and additional machinery installed.

The plant of the Cedar Shingle Company, Tacoma, Wash., was destroyed by fire.

The Northern California Power Company, Sacramento, Cal., contemplates the installation of a new pumping equipment for its water system at Willows, Cal.

The Citizens' Light and Power Company, Sacramento, Cal., recently organized, is planning to install a light and power system to cost $1,500,000. The company will erect a new power plant in the near future. George W. Peltier is head of this company.

CANADA

Milton, Ont., will install new waterworks.

Orillia, Ont., will spend $80,000 on electric power plant.

Cardston, Alberta, will install a new waterworks system.

West Lorne, Ont., will install a complete new waterworks system.

The Dominion Flour Mills will equip a new $75,000 plant at Montreal.

Hull, Que., will spend $100,000 on extensions to its waterworks system.

The Preston Woodworking Company will equip a new plant at Preston, Ont.

The Montreal Street Railway Company will make important extensions to its system.

Fire did heavy damage to the plant of the Canada Cement Company, at Shallow Lake, Ont.

The Granby Smelting Company will equip a $2,000,000 smelting plant at Goose Lake, B. C.

The Diamond Flint Glass Company is building a big addition to its factory at Hamilton, Ont.

The Brown Smith Turning Company, of Broadbent, Ont., will locate a new factory at Parry sound.

The British Columbian Hydraulic Power Company will equip a big new plant at Nanaimo, B. C.

Fire did $50,000 damage to the plant of the Wallace Shipyard Company, at North Vancouver, B. C.

The Globe Printing and Publishing Company will make important extensions to its plant at Toronto, Ont.

F. H. Latimer, Penticton, B. C., is calling for tenders for generators and other equipment for an electric-lighting system.

The Superior Pulp and Paper Company will build a large paper mill at Sault Ste. Marie, Canada. Will install a large battery of boilers in its power house there also.

J. Fannell, of Trenton, Ont., is head of a company which is building a big new factory there for manufacturing go carts and baby carriages.

The plant of the Ladysmith Lumber Company, at Nanaimo, B. C., was damaged by fire. Machinery loss, $20,000. Will be replaced immediately.

Lundy & McLeod, of Edmonton, Alberta, are at the head of a $1,500,000 company, which will equip a big power plant and manufacturing plant near there.

The F. M. McGuigan Construction Company, of Toronto, will buy large quantities of pumps and machinery for new filtration plant. Estimated outlay, $1,000,000.

MINING

The Buckhorn mine, near Newsome, Ida., will build a new milling plant.

The Newsboy Mining Company, Fairbanks, Alaska, will install a 5-stamp mill.

The Scottish Chief mine, near Redding, Cal., is planning to build a 10-stamp mill.

The Baltimore Mining Company, Yerington, Nev., will install a new milling plant.

The Hypotheek Mining Company, Wallace, Ida., will install a new concentrating plant.

The Gold Fountain Mining Company, Hailey, Ida., will install a 60-stamp mill.

The Gran Lucero mine, near El Oro, Durango, Mex., will install new cyanide equipment.

The Snowshoe mine, Libby, Mont., contemplates the erection of a large concentrating plant.

The Richfield Copper Company, Arispe, Sonora, Mex., will build a new smelting plant.

The Ora Belle Mining Company, Hart, Cal., is having plans prepared for a new cyanide plant.

The Jewett Mining Company, near Grants Pass, Ore., contemplates the installation of a new mill.

The Ewin Peaks Mining Company, near Duncan, Ariz., plan for the erection of a 5-stamp mill.

The Golden Gate Mining Company, Greenhorn district, Grant county, Ore., will install a new stamp mill.

The Black Hawk mine, near Nelson, Nev., will remodel its mill and install new concentrating machinery.

The South Des Moines Coal Company, Des Moines, Ia., will open up a mine on its 440 tract of coal land near that city.

The Clara Consolidated Gold and Copper Mining Company, near Swansea, Ariz., will increase the capacity of its smelting plant.

The Gundaker mine, near Tucson, Ariz., plans for the erection of a 50-ton concentrator. S. W. Gundaker is head of this property.

C. T. Brown, Socorro, N. M., is at the head of a company which plans for the erection of a large smelting plant in the Kingston district, near Hillsboro, N. M.

The Gold Road mine, near Kingman, Ariz., has been acquired by the United States Mining and Smelting Company. The new owners will make improvements in the property and install new machinery to the extent of $500,000.

BUSINESS ITEMS

The trade designation of the "Franklin" compressors, made by the Chicago Pneumatic Tool Company, will hereafter be the "Chicago-Pneumatic" compressors.

The Skinner Chuck Company, New Britain, Conn., has purchased the drill-press vise business of the Hopkinson Machine Company, Springfield, Mass. The Skinner Chuck Company will, by this purchase, increase the number of vises manufactured, introducing a small vise, especially for toolmakers' use, and a large size vise, namely, 7½ inches, than it has heretofore manufactured.

TRADE CATALOGS

The Walter H. Foster Company, 50 Church street, New York. Catalog. Hydro-pneumatic radial drill. Illustrated, 8 pages, 6x9 inches.

Standard Wrench and Tool Company, Providence, R. I. Catalog. "Fitzall" nut and pipe wrench. Illustrated, 12 pages, 3x6 inches.

The Ready Tool Company, Bridgeport, Conn. Folder. Roughing tools, threading tools, boring bar. Illustrated, 14 pages, 3½x6 inches.

The American Oxhydric Company, Milwaukee, Wis. Catalog. Oxhydric process for cutting and welding metals. Illustrated, 30 pages, 6x9 inches.

Armstrong Brothers Tool Company, 339 to 357 N. Francisco avenue, Chicago, Ill.

Booklet No. 4. Ratchet drills. Illustrated, 8 pages, 3½x6 inches.

The Corona Manufacturing and Supply Company, 311 Atlantic avenue, Boston, Mass. Folder. Corona drill, reamer and milling-tool socket. Illustrated.

Revolute Machine Company, 417 East Ninety-third street, New York. Catalog. "Blue Streak" continuous electric blueprint machine. Illustrated. 12 pages, 4x6 inches.

The Hess-Bright Manufacturing Company, Twenty-first street and Fairmount avenue, Philadelphia, Penn. Pamphlet. Form No. 546-4A. Ball-bearing hangers. Illustrated, 32 pages, 6x9 inches.

FORTHCOMING MEETINGS

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Test indicators. H. A. Lowe, Cleveland, O.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Autogenous welding of broken cylinders and crank cases is most expertly done by Waterbury Welding Works, Waterbury, Conn.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Opening for specialty in machinery line, device or machine is wanted to start new manufacturing enterprise; must stand thorough investigation. Address with particulars, "Enterprise," AMERICAN MACHINIST.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Patents—An able mechanical engineer will see and protect technical points better; valuable suggestions and assistance in developing inventions. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraph Company, Baltimore, Md.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Pierce Manufacturing Company, Woonsocket, R. I.

Wanted—Party or parties to buy outright or to take a license on the basic patents on the only automatic continuous solids and filter press in existence, pressing between cloths, loading and unloading automatically; pressing can be regulated to any extent with or without hydraulic or screws, or it can be run as an ordinary press at the same time doing away with the trouble of taking apart the machine to remove the cakes; manufacturers will require no special machinery; the press can be seen in operation and a thorough investigation made of its many possibilities. K. S. Berrigan, sole owner, 136 North Centre street, Orange, N. J.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

INDIANA

Wanted—A man who has made gearing and gear cutting a specialty; one who understands gearing technically; interesting proposition for right party. Box 111, AM. MACH.

IOWA

Wanted—General superintendent, capable of taking complete charge of thriving and fast growing factory making general line of steel stampings; location in good mid-western city; runs about thirty punch presses, with full supplemental equipment, employs seventy operatives; must be first class executive, good disciplinarian, able to handle labor, and to turn out the work; only thoroughly equipped and experienced man need apply; place demands a good man and will pay for him, but wants full value received; no beginners or failures wanted, but the chance of a lifetime for the right man; state fully and clearly your qualifications, experience, age and salary desired; all will be held strictly confidential. Address "X," Box 50, AM. MA.

KENTUCKY

The Universal Stenotype Company, Owensboro, Ky., organizing factory for production of writing machine, requires services of toolmakers, die makers, machinists, screw machine men and punch press men; only applications from mechanics having best of references will be considered; young men preferred; fine opportunity for rapid advancement. Address "Superintendent," enclosing references.

MASSACHUSETTS

Superintendent wanted for rapidly growing machine tool factory now employing 30 men; manufacturing one standard machine only; splendid opportunity for an energetic young man; make application in writing, giving age, experience and references. Universal Boring Machine Co., Hudson, Mass.

Draftsman Wanted—An experienced mechanical draftsman, preferable with a technical education, or a number of years' practical shop experience, by a large manufacturing concern in Massachusetts; state age, experience and salary expected by addressing "Chief Draftsman," Box 109, AMER. MACH.

Wanted—First class tool designer to take charge of tool drafting room of manufacturing company; must be experienced and competent in design of jigs, fixtures, punches, dies and other special tools used for quantity production of light machine parts on an interchangeable basis; give technical education, detailed shop and office experience, places and periods of employment, references, age and salary expected. Address "D," Box 1574, Springfield, Mass.

MICHIGAN

Foreman wanted for light hardware manufacturing in department of stamping and automatic screw machines; give age, experience, references and wages required. Box 96, AM. M.

Wanted—Gear expert; a large corporation will employ a first class bevel gear man who understands thoroughly the technical as well as the practical side of bevel gear production; must be able to produce highest grade of hardened gears; liberal salary to man who can produce the goods; state age, experience and salary expected. Address Box 113, AM. M.

Wanted—Two energetic and practical foremen, one to take charge of a large screw machine department, consisting of automatic and hand machines, and who understands bar and forge work; the other to take charge of a drill press department, consisting of radial and upright drills, in a large and progressive automobile concern; applicants must be between 35 and 45 years of age, and none but first class men who mean business need apply. Kindly state experience and lowest salary wanted. Address Box 134, AMER. MACH.

MINNESOTA

Wanted—First class foreman to take charge of manufacture of marine gasolene engines; one who thoroughly understands the handling of tools and the turning out of work in first class order; steady employment and good wages will be paid to the right man. Apply to the Campbell Motor Co., Wayzata, Minn., stating experience.

MISSOURI

Experienced designer on general machinery; give reference, experience, education and salary expected. Box 114, AMER. MACHINIST.

NEW JERSEY

Wanted—At once, mechanical draftsman for cranes; one with experience on structural work preferred; state salary and experience. Sprague Electric Works, Bloomfield, N. J.

We will have openings for machinists and toolmakers during July; mail your application, giving references and wage at last place. Crane Motor Car Company, 96 West Seventh street, Bayonne, N. J.

NEW YORK

Wanted—Designer, power presses, heavy dies, rolling machinery. Box 140, AM. MA.

Wanted—Foreman for car forge works, experienced with forging presses, bulldozers, heading machines, Bradley hammers, etc. Address Box 127, AMERICAN MACHINIST.

Wanted—Draftsmen, experienced on tools, jigs and fixtures for the manufacture of small interchangeable parts; state age, experience in detail and salary expected. Box 124, AM. M.

Wanted—Foreman for drop forge shop, operating steam drop hammers on crank shafts, axles, automobile parts and other particular forgings; state experience in detail. Address Box 126, AMERICAN MACHINIST.

Acetylene welding operator, steady city job at good wages is offered to a thoroughly experienced man on high grade bench welding. Address, with references, H. W. Shannard, Care E. W. Bliss Co., 17 Adams St., Brooklyn, N. Y.

Wanted—Energetic foreman and assistant foreman for large machine shop; men required who are capable of directing 30 to 50 men and boys. Addrss stating age, experience, references and wages desired. Box 128, AMERICAN MACHINIST.

Wanted—Salesman to handle a complete line of planing mill exhausters, steel plate fans, blowers, dust collectors, ventilators, etc., on a commission basis; liberal terms and choice of territory to reliable parties. Address Box 107, AMERICAN MACHINIST.

Wanted—Machinists wanted. lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Salesmen—Manufacturers of a well known special machine used by the metal working trades seek the services of competent salesmen as field representatives to handle this machine exclusively; ability to make good on large propositions is essential, and familiarity with turret lathe practice desirable. Address Box 108, AMERICAN MACHINIST.

Superintendent wanted for manufacturing plant near New York; no experience in manufacturing this line of goods necessary, but applicant must show proof of ability to successfully manage a manufacturing plant; exceptional opportunity and good salary; state experience, age and salary expected. Address "M. C.," AMERICAN MACHINIST.

Wanted—First class machinists, erectors, toolmakers, die sinkers, lathe, planer, screw machine, boring, milling and gear cutting machine hands; Jones & Lamson, Gisholt operators and Norton grinders; clean uptodate shop; steady position. Apply, giving account of past experience, names of previous employers and wages expected, to R. Hoe & Co., 504 Grand St., New York.

Wanted—Machinery salesman, live and energetic, with theoretical and practical experience in gear cutting, for selling high grade, well known line of modern gear cutting machines; first class opportunity for capable hustler; state age, salary desired, former experience and territory covered; only men with thorough experience in gear cutting line will be considered. "S. G.," AMER. MACHINIST.

NORTH CAROLINA

Wanted—German-American mechanic, who has some knowledge of mechanical drawing, as foreman of machine shop in small town; state experience, present position, age and salary expected. S. Parker, Pine Town, N. C.

OHIO

One lathe crank shaft man wanted. Box 136, AMERICAN MACHINIST.

Wanted—Drafting room designer, familiar with gas engines. Box 135, AMER. MACH.

Competent operator for Acme and Gridley automatics, good money for a live wire; give full particulars, regarding ability, etc. Box 129, AMERICAN MACHINIST.

Wanted—An experienced operator on automatic screw machine; must be capable of estimating on work; also designing the tools for same. Box 97, AMERICAN MACHINIST.

Wanted—Assistant foundry foreman in grey iron foundry; state experience, class of work, former employer, age, salary expected and when free to take position. Box 103, AMERICAN MACHINIST.

Wanted—An office manager with practical experience in mechanical lines and is able to invest $5000 for ⅓ interest, in manufacturing a machine that has no competition and is an immense seller. Box 149, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Wanted at once, first class pattern maker foreman for wood and metal patterns; must be capable of applying patterns to molding machines and estimating costs; must also be competent to assume complete charge of pattern shop of twenty-five pattern makers and responsible for pattern shop costs and everything pertaining to that department. State age, experience, salary expected, former employers and references. The Modern Foundry Company, Oakley (Cincinnati), Ohio.

PENNSYLVANIA

Wanted—Instructors in mechanical engineering, in electrical engineering and in mechanical drawing at an eastern institution; applicants must be graduates of technical schools, preferably with one or two years' practical experience. Box 78, AMER. MACH.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—By a responsible drop forging concern, an experienced man to take charge of estimating department; state fully past experience and qualifications. Address "J. N.," AMERICAN MACHINIST.

VERMONT

Salesmen—We want several salesmen to sell Gridley automatics; applicants should give full particulars as to experience and state salary expected. Windsor Machine Co., Windsor, Vt.

WASHINGTON

Wanted—An assistant foreman, young and uptodate, who understands sawmill and engine work, to have charge of floor and bench hands; from 15 to 30 men under him; good job for the right man. Address, Sumner Iron Works, Everett, Wash.

WISCONSIN

Assistant superintendent; we have a good position for a capable man; one who can take charge of detail factory work; experienced in stamped steel novelties. Address "W. D. B.," AMERICAN MACHINIST.

Wanted—General foreman and department foremen for machine shop (400 men) in modern works manufacturing automobile parts; applicants with mechanical and executive experience on interchangeable and repetition work, using uptodate equipment, will be considered; state age and experience. Box 146, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

MASSACHUSETTS

An experienced executive and practical mechanic, competent draftsman and designer of tools and special machinery, desires responsible position. Box 120, AMER. MACHINIST.

Position as tool and die room foreman; have had wide experience as foreman and tool and die designing; shell drawing a specialty; can furnish A-1 references. Box 141, AMERICAN MACHINIST.

Responsible position by mechanical engineer and designer, eleven years' experience on automatic machinery; has held position of chief draftsman; now employed. Box 138, AMERICAN MACHINIST.

NEW JERSEY

Efficiency engineer, conversant with theory of uptodate efficiency methods and their practical application, in responsible position, desires change. Box 152, AMER. MACHINIST.

Wanted—Management of medium size factory feeling strain of competition or lacking progressive spirit, by mechanical engineer of thorough training and experience, familiar with high class work and correct methods; salary nominal plus commission on increased profits; must be convinced of broad possibilities of field. Box 145, AMER. MACHINIST.

NEW YORK

Rapid lathe, planer, boring mill hand wants job. Box 150, AMERICAN MACHINIST.

Oxy-acetylene, expert operator, at present employed, desires change; go anywhere. Box 132, AMERICAN MACHINIST.

Foreman, tool room and modern manufacturing training, desires to change; reference first class. Box 137, AMERICAN MACHINIST.

Foreman, tool room and manufacturing successful increasing production, reducing manufacturing costs, wishes to change. Box 139, AMERICAN MACHINIST.

Wanted—By superintendent, now employed, position with reliable firm; New England preferred; American; age 40; $3000 smallest salary considered. Box 133, AMER. MACH.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Toolmaker, experienced in all branches, at present in charge of screw machine department, wants to connect with concern where highest grade work is really needed; adaptable, resourceful, self-reliant; age 33. Box 147, AMERICAN MACHINIST.

Superintendent and factory manager, high class and efficient, expert on tools, dies, gages, machine building, interchangeable parts, foundry, structural steel and sheet metal products; thoroughly understands handling help, hustling out work; production my specialty; never failed to exceed all expectations; now employed. Box 130, AMERICAN MACHINIST.

Position as manager, chief engineer or superintendent, by mechanical engineer with experience in internal combustion engines, steam engines and boilers, automobiles and shop equipment; first class organizer, estimator and handler of men who can make permanent improvements in product and in production; at present employed. Box 151, AMER. MACH.

OHIO

Wanted—Position by tool room foreman; A-1 mechanic in punch and die, also drop forge die work, open for engagement August 15. Box 121, AMERICAN MACHINIST.

Wanted—Position as cost accountant; nine years' experience in foundries and machine shops; competent to reorganize and take charge of accounting department. Box 143, AMERICAN MACHINIST.

PENNSYLVANIA

Draftsman and tool designer with shop experience will be open for position about August 5; age 27. Box 110, AMER. MACHINIST.

Practical toolmaker desires foremanship tool room; was foreman toolmaker on Panama canal; has traveled considerably. Box 131, AMERICAN MACHINIST.

Designing draftsman, from sketches, schemes from conception to detail conclusion; care of interchangeable parts; fine designer original and suggestive; acted as supervising draftsman. Box 82, AMERICAN MACHINIST.

RHODE ISLAND

A-1 toolmaker and machinist, 20 years' experience in machine shop and tool room; competent to handle men, wants position as machine shop or tool room foreman. Box 142, AMERICAN MACHINIST.

WEST VIRGINIA

Situation Wanted—Salesman, machinery or mechanical goods, by an energetic man with 11 years' shop and drafting experience; good appearance and education; any territory. Box 148, AMERICAN MACHINIST.

WISCONSIN

Tool designer, expert on jigs, fixtures, special machinery and all labor saving devices, with inventive ideas, 18 years' experience as toolmaker and designer, executive ability, desires change of position as chief tool designer, assistant superintendent or master mechanic; age 34; A-1 references; Middle West preferred. Apply under "O. K.," AM. MACH.

FOR SALE

For Sale—A complete machine shop with large lot, equipped with first class machinery, located along the East Penn Railroad. For further particulars and prices apply to P. B. Nuss, Alburtis, Penn.

Machinists business for sale in Newark, N. J., employing 15 men; lathes, gear cutters and full equipment doing profitable general and auto parts business; satisfactory reasons for disposal. Apply Box 144, AMER. MACH.

Metal Clothes Lockers—We bought too many and are offering about 300 expanded metal clothes lockers for sale at a sacrifice; all brand new; size 12x12x60 inches; made by Merritt & Co., of Philadelphia; chance to equip your factory cheaply. Metric Metal Works, Erie, Penn.

Machine shop for sale in a manufacturing town in New Jersey; saw tooth roof and steam heated; lathes from 9 inches up to 42 inches; good chance for one or two bright mechanics to invest a few thousand dollars; an excellent opening for automobile shop and foundry along with present business. Box 88, AMERICAN MACHINIST.

For Sale—Two fine factory buildings, excellently located in Rochester, N. Y., on St. Paul and Hand streets; one has 31,480 square feet, the other 57,100 square feet floor space; both constructed for heavy manufacturing, have splendid natural lighting and are equipped with large capacity electric elevators; electricity and steam heat furnished at cost; buildings to be vacated by Yawman & Erbe Company, world famous manufacturers of filing systems, who are to occupy larger plant now building. For illustrated booklet and maps with complete information, write to C. F. Garfield Real Estate Company, Garfield building, 1 Exchange street, Rochester, N. Y.

Talks With Our Readers

By The Sales Manager

The President of the United States is in Boston this week.

As are also the Governors of five or six States.

They are present at the convention of the Associated Advertising Clubs of America.

There to stamp with their approval the discussion of one of the greatest forces in the commercial world today—advertising.

Ten or fifteen years ago the gathering of such an assemblage of men trained in advertising and salesmanship was impossible.

Advertising then was surrounded with mystery, savored too much of the black art, and at its best was a gamble. Few knew anything about it and they were looked upon with suspicion.

The change, the evolution in advertising has been as great and a good deal more rapid than that in engineering.

Advertising is now a legitimate, productive, dividend paying investment if it's systematically planned and properly followed out. Just as legitimate as any other department of modern business.

The time is fast going by when people will stand for exaggeration and misrepresentation—"white lies" in advertising. They will no longer make allowances and say "Oh, that's only advertising."

Buyers now demand accuracy in the printed word.

* * *

One of the questions to be discussed in the convention under the topic of "Some of the Problems of an Advertising Manager" is "What kind of advertising should be accepted?"

This is not a problem with the AMERICAN MACHINIST. As far as we are concerned it's solved—in favor of our readers.

Only reliable concerns having products that can be used to advantage in and around machine making plants can advertise in the AMERICAN MACHINIST.

Your attention is not distracted by subjects you are not interested in.

Only reliable products can be advertised in the AMERICAN MACHINIST.

The best buying insurance you can possibly have.

The Mechanics of the Edison Battery

By Fred H. Colvin*

The Edison storage battery is a thoroughly mechanical proposition in addition to its electrical qualities. It is built in such a workmanlike manner that no mechanic can follow its construction through the factory without being impressed with both the design of the battery and the guiding spirit which is responsible for the various methods of producing it.

This is entirely different from any other storage battery, in that its construction is entirely of steel and that an alkali, potash, is used instead of an acid. The elements are nickel flake and nickel hydrate for the positive, and iron oxide for the negative. But instead of the usual grid of lead with the active material pasted into it, we find both the nickel and the iron inclosed in perforated steel pockets and clamped into the sheet-steel grid by hydraulic pressure.

The Edison battery is so different from any other that it requires new methods as well as special machines for its production.

These begin with the production of nickel flake one-twenty thousandth of an inch thick and only end when the battery is ready for use.

The steel used, the methods of handling it; the automatic loading of the active elements; the automatic nickel-plating devices; the semi-automatic welding machines and other devices give an idea of the many problems involved and reflect the master mind behind the ideas involved.

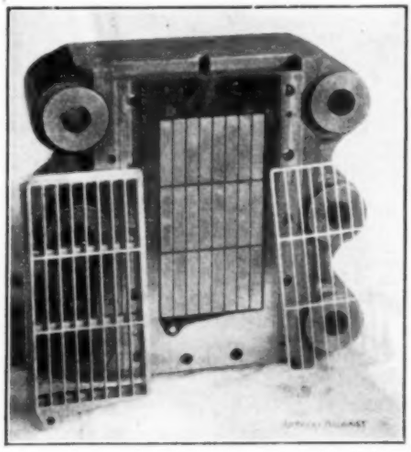


FIG. 1. DIE FOR NEGATIVE GRIDS WITH STRIPPER REMOVED

MAKING THE GRIDS

The making of the sheet-steel grids gives some fine examples of punch and die work as can be seen in Figs. 1, 2 and 3. The first shows a subpress die for the negative grid with the stripper removed and standing at the left, while a finished grid stands at the right. The 24 rectangular holes together with the outside round one are all punched at one operation. The positive grid is blanked, slotted and pierced in one operation.

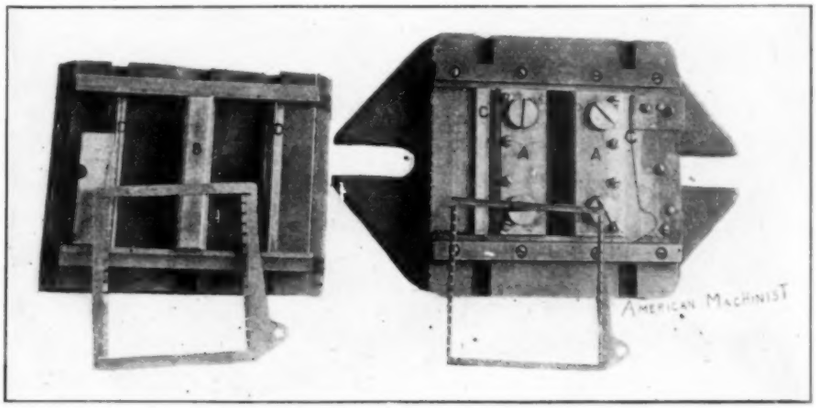


FIG. 3. DIE FOR CRIMPING THE GRID FINGERS

The completed elements, ready for the case, are shown in Fig. 2. This gives a good idea of the mechanical way in which it is built and shows the result of the various operations described.

In Fig. 3 is a crimping die for a smaller sized positive grid. The grid at the left has just been blanked and slitted, then the fingers bent up in another die, and is ready to have the fingers bent over, as seen in the other grid. The bottom die is at the right and the two jaws *A A* can be forced apart by the central plunger *B* of the upper position. This forces the sharp bevels *C C* outward and crimps the fingers between these and the stationary parts *D D*.

Both the positive and negative grids are shown in their various stages in Fig. 4.

MAKING THE POSITIVE TUBES

The tube for the positive element of the battery and which contains the nickel flake and the nickel-hydrate is very ingeniously made from a continuous strip of sheet steel, as will be seen.

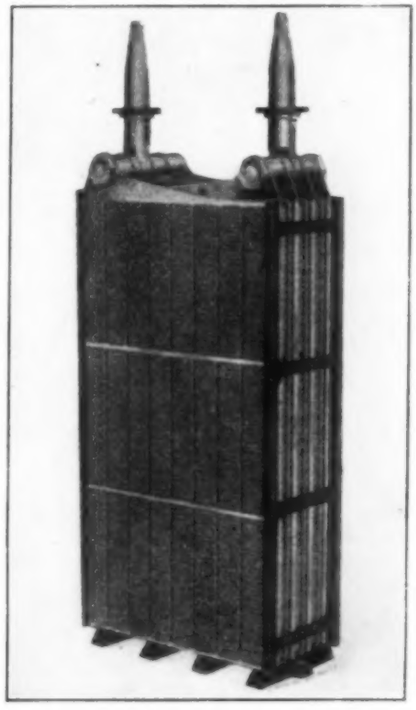


FIG. 2. THE BATTERY ELEMENTS READY FOR THE CASE

Steel comes in strips about 3 inches wide and 0.005 inch thick and is run between slitting rolls which cut it into strips of the desired width. These strips then run between the rolls of the perforating machine shown in Fig. 5 perforating the strip from one side. The perforating roll is on top and the receiving roll beneath, the latter being adjusted by the jack-screws shown.

This leaves a decided bur on the underside of the ribbon, which is ground

off in the machine shown in Fig. 6. The reel containing the perforated ribbon is placed on top of the machine being held on the spider spool shown. From here the ribbon is threaded over a roll directly in front of the grinding wheel and back through the receiving rolls to the receiving spool beneath. This machine grinds off the projecting bur and leaves the ribbon about 0.009 inch thick. It will be noted that the parts of the grinding yokes, excepting the first, being of porcelain and the rollers running on glass rods, so as not to be attacked by the plating solution.

After the ribbon is threaded in as shown and connected with a reel at the other end of the beam, the whole thing is lowered until the beam rests on the raised end of the tank, so that the ribbon is submerged excepting where it goes over the upper rollers.

At the further end of the machine it is carried through the usual cleansing solution after nickel plating.

The roll into which the ribbon winds is

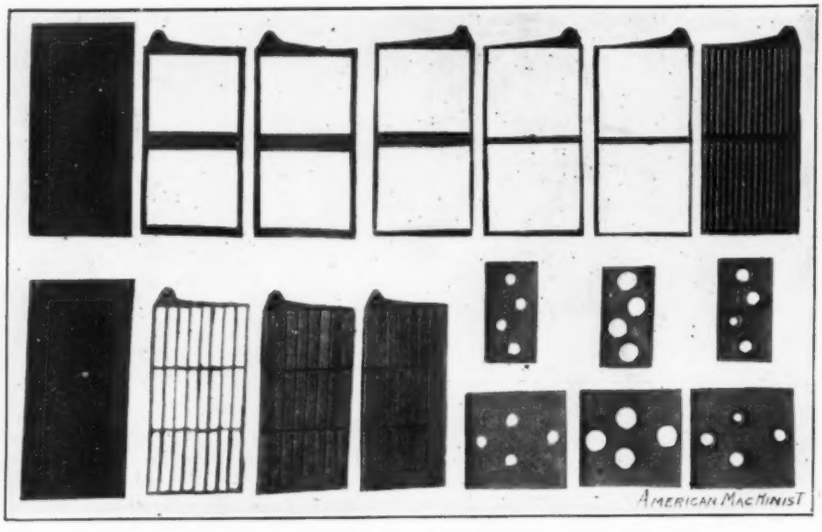


FIG. 4. OPERATIONS ON THE GRIDS AND BATTERY TOPS

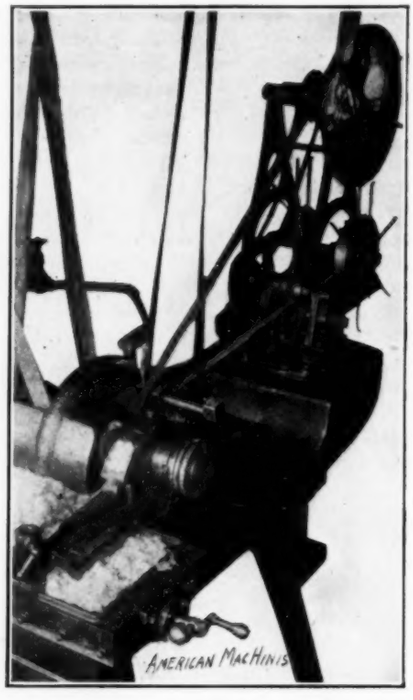


FIG. 6. GRINDING THE BURS FROM THE RIBBON

machine liable to be affected by the dust are packed with waste which can be easily changed and which prevent an accumulation of the fine particles of steel around the machine.

BRUSHING AND ANNEALING

After the ribbon comes from the grinding machine, it is threaded through the brushing machine shown in Fig. 7, where the wire brush wheels shown brush off all the loose particles of steel or abrasive. It will be noted that some of these brushes revolve crosswise of the ribbon which insures every loose particle being removed. This is a double machine, the other side not being in use when the photograph was taken. From the brushing machine the ribbon goes to nickel plating department.

ELECTROPLATING TO PREVENT RUST

After the grids and ribbons, as well as every steel part entering into the construction of the battery, are finished, they go to the electroplating department, to receive the coating of nickel. The grids and other steel parts are nickel plated in the regular way.

The steel ribbon, however, is handled in a very ingenious manner, as can be seen in Fig. 8. The reel is placed on a shaft at the end of a long beam, and the ribbon fed over the rollers shown, and is then threaded, as can be plainly seen in the illustration, all the rollers and

The first arm, which projects downward, carries it through a hot solution of caustic soda for thoroughly removing the dirt and grease, while the first porcelain spool carries it into a washing solution, after which it goes directly into the nickel solution and receives a fairly heavy coat, which effectually protects it against rust in all future operations and in use in the battery itself.

power driven, and it will be noticed that the shaft directly under the beam drives some of the rollers through spiral gearing, so as to avoid undue strain on the ribbon by driving at regular intervals.

FUSING (ANNEALING)

From the plating machine the ribbons go to the annealing or fusing room, being placed in the annealing pots shown in

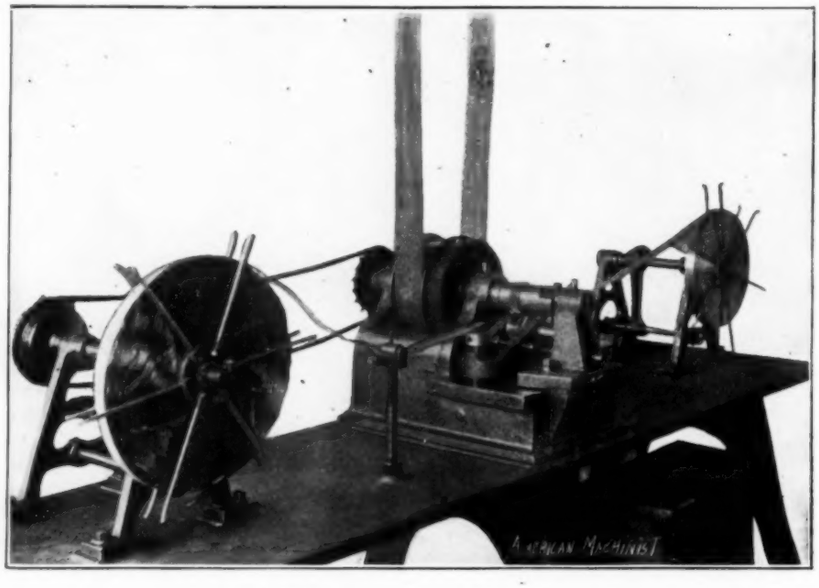


FIG. 5. PERFORATING THE STEEL RIBBON

Fig. 9. These are made according to the shape of the material being annealed, the round ones being for the spools of ribbon, and the others for the grids, after they are blanked out.

It will be noted that the covers of these annealing pots are very carefully bolted into place and that they are provided with packing grooves into which asbestos is laid so as to insure their being air-tight. It will also be noted that there are two pipes leading from each annealing pot, one from the top and the other from the bottom. When the annealing pots are in place in the bricked furnaces, these pipes project and allow a mixture of hydrogen gas to be forced through the pots, which secures uniform annealing and unites the nickel firmly to the steel, no matter how many pieces may be packed in each pot.

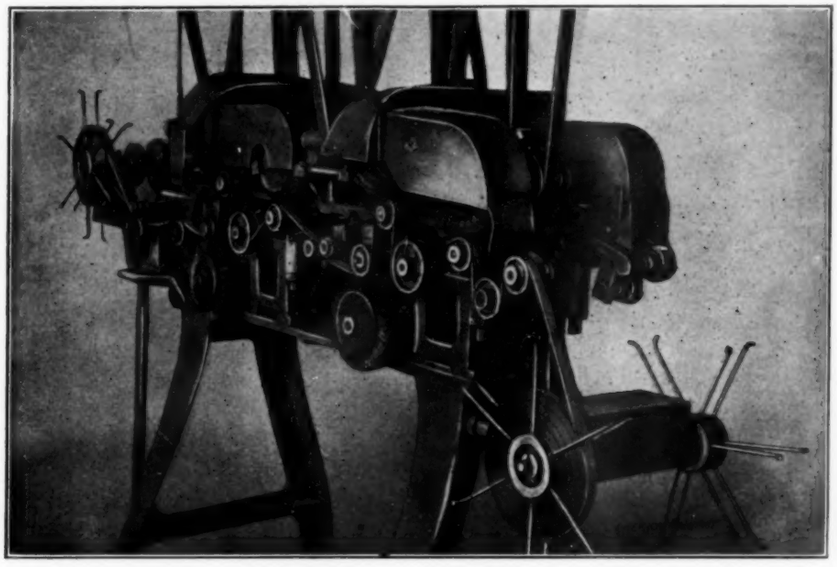


FIG. 7. BRUSHING MACHINE FOR REMOVING LOOSE PARTICLES OF STEEL OR ABRASIVE

FORMING THE TUBES

The ribbon is then ready to be rolled into tubes for the positive element, this being done on the machine shown in Fig. 10, which is automatic and extremely interesting. The ribbon spool is placed in the fork shown at the end of the machine and goes through guides which are shown in detail in Fig. 11. The upper guide plate is open to show the passage of the steel ribbon after leaving the first pair of rolls *A* which turn one edge *B* up and the other *C* down, as can be seen. The ribbon then feeds around the mandrel *M* and between the rollers *R*, shown, in such a way that the turned edges come together and form a double-lapped spiral seam which is pressed down by the last pair of rolls, making a very substantial tube.

The head *H* carrying the chuck *C* has a longitudinal motion on the bed, the chuck jaws opening as the head moves toward the rolls, allowing the chuck to pass over the portion of the tube already formed. As soon as the head starts back the chuck jaws close on the tube, revolving it and at the same time running back toward the position shown, which draws more ribbons between the forming rolls.

The movement of the head *H* determines the length of the tube and while the head is moving up to secure a fresh grip, the small saw *S* cuts off a tube of the correct length and drops it into the hopper shown, which has the trap door on the lower end.

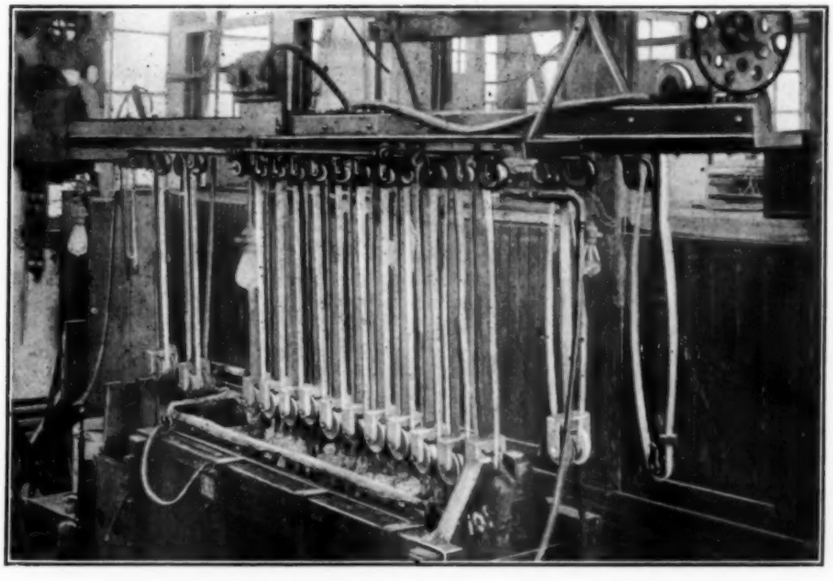


FIG. 8. CONTINUOUS ELECTRIC PLATING DEVICE

LOADING THE TUBES

The tubes then go to the automatic loading machines, one of which is shown in Fig. 12. Each of the tubes is clamped in the loading fixture shown in the foreground by the swinging bolts, the whole fixture being slid under the machine and held in place by the two clamping screws shown in front. The flake nickel is placed in the hopper at the back while the nickel hydrate is in the front hopper. Suitable slide cutoffs or valves allow alternate charges of nickel flake and nickel-hydrate to pass down the loading chute into the tubes held in the fixture beneath.

Each charge is rammed down by a gravity plunger operated by ratchets which can be seen at the back of the iron-oxide loading machine in Fig. 16. When these tubes are loaded with about 375 layers of alternating nickel flake and nickel-hydrate, they are removed from the machines and go to small-bench machines which gage in the length of the loading by reaming out the surplus to the exact depth. Small caps are then placed in either end.

The tubes have the ends closed on the machine shown in Fig. 13, which operates very simply, but very effectively. The tube is held in place by the descending spring plunger under control of the foot treadle and its further movement operates the closing jaws *J J*, by means of the inclines *B D*, which first force the open jaws over the end of the tubes and then close them by a further movement. The tube is removed from the machine by pressing the lever *L*, lifting it out of place.

The ends are then trimmed to length in a little punch press and the tubes are then ready to be banded.

INSPECTING THE TUBES

A few tubes are taken from each batch and sawed lengthwise by a small circular saw arranged for this purpose. These sawed tubes are then taken to the inspection room and the distribution of

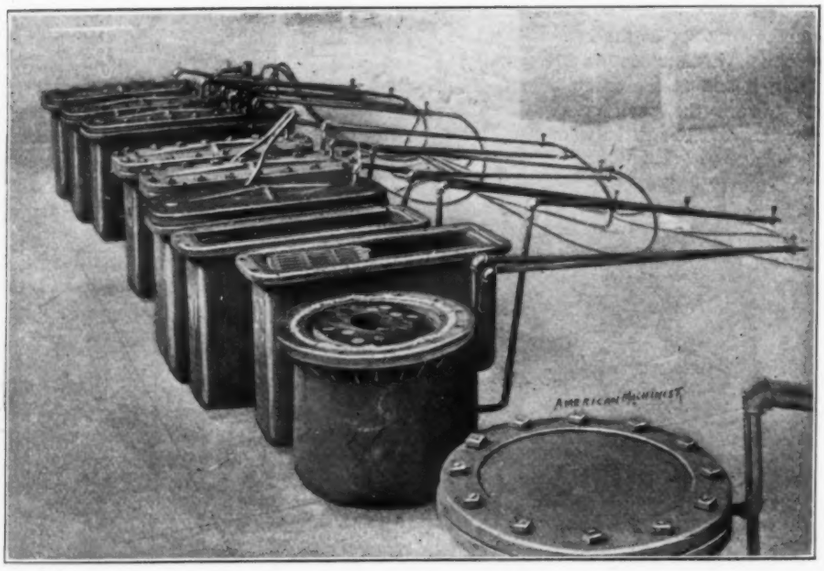


FIG. 9. ANNEALING POTS FOR RIBBON

the layers of nickel flake and nickel-hydrate are carefully examined under the microscope, so as to be perfectly sure that all is going well with the loading machine. This inspection includes the counting of the layers, so that the variation in number can be kept within very close limits, it being practically impossible to load tubes exactly alike, as a few grains more or less of either the flakes or the hydrates in some of the layers, makes more difference than might be imagined in the total number.

BANDING THE TUBES

After the ends are closed, the tubes go to the banding machine shown in Fig. 14, where eight small steel bands are forced over the tube to prevent expansion and stiffness. The tube is first laid on the supports shown and a ring is dropped in each of the eight slots shown in the top of the block in the center. The handle at the left forces the sizing rod through these. The upper lever is then pulled down so that the eight small plungers hold the rings in place. Then a movement of the lever at the right forces the loaded tube through the eight rings. It is then removed by raising the upper jaw of the clamp as shown. This leaves the positive tubes in position to be assembled in the steel grid.

These are put in place by hand, each adjoining tube having an alternate spiral so that any tendency to twist from this course will be counteracted.

THE NEGATIVE OR IRON OXIDE POCKETS

In the meantime the flat pockets for the oxide of iron or negative elements are being prepared from the same kind of a perforated ribbon, but are formed upon a punch press in dies so nicely adjusted that even with this very thin material there is an "inside" and "outside" to each box, which fit each other perfectly. These are so light that they are blown out of the punch-press die by a jet of compressed air which is controlled by a valve connected to the ram of the press.

These are put together very rapidly and go to the loading bench, where they are slipped into the loading clamps or vises, and the sizing mandrels slipped in the inside, insuring that each box or pocket has the proper capacity for the iron oxide which is to be loaded in it. This loading block is then slipped under the little machine shown in Fig. 15 so that the lifting pins shown in the cross-bar engage the holes in the top of the mandrels and these are rapidly withdrawn by a turn of the crank at the right.

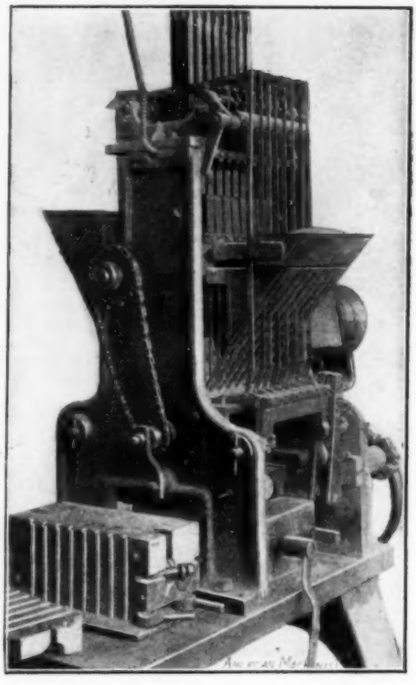


FIG. 12. LOADING MACHINE FOR POSITIVE TUBES

The fixture with its empty pockets is now placed under the loading machine shown in Fig. 16, which feeds and compresses the iron oxide in place. Both views of these machines are shown, the rear view giving a good idea of the way in which the ratchets lift the ramming plunger and allow it to fall by gravity.

As soon as these are loaded the fixture containing them is slipped under a

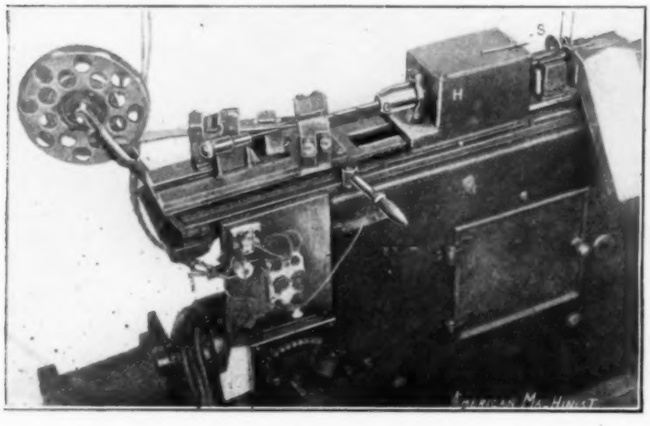


FIG. 10. MACHINE FOR FORMING THE POSITIVE TUBES

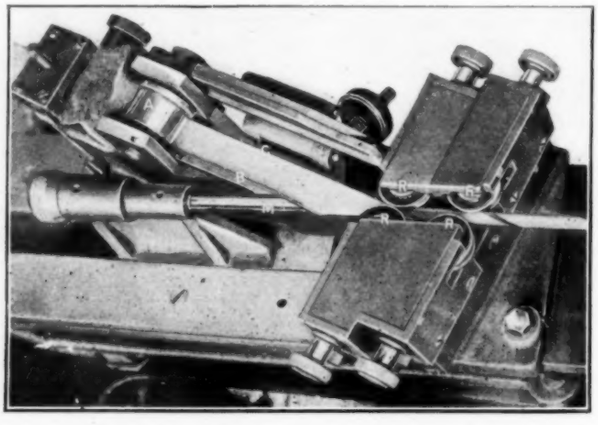


FIG. 11. HOW THE RIBBON IS FORMED

capping machine, which turns over the top and presses it down to a standard size, so that each pocket is ready to be fitted into the negative grid. The grids are then laid on a form which allows these pockets to be easily slipped into place and the loaded grids then go to the hydraulic presses.

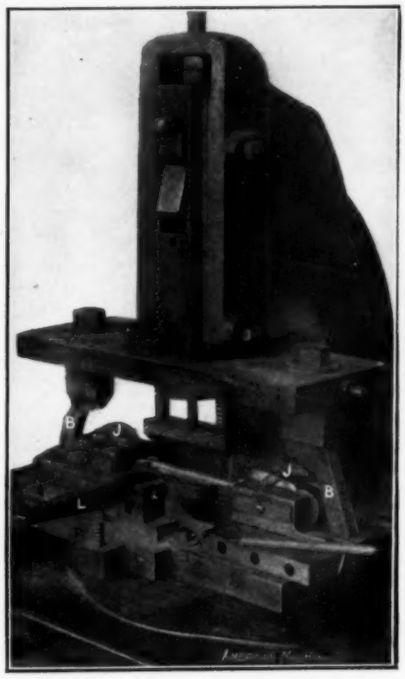


FIG. 13. CLOSING THE ENDS OF THE TUBES

Both the positive and negative grids after being filled with the proper tubes and pockets go to one of the hydraulic presses shown in Fig. 17, where a heavy pressure of about 160 tons for the negative and 70 tons for positive tubes secures them firmly in place. In the case of the positive grids, the fingers are forced down solidly over the flattened tube ends while the negative or iron pockets are flattened slightly to set them firmly into place. When done they are practically a solid plate and seem to be proof against injury in service.

MAKING NICKEL FLAKE 0.00005 INCH THICK

The method of obtaining nickel flakes for the positive tubes is extremely interesting and ingenious, and reflects the ingenious methods of the designer of the battery.

It was impossible to obtain these flakes by rolling of anywhere near the desired thinness, so resort was made to electroplating and interesting machinery devised for doing this commercially in a manufacturing way.

A number of large machines, one of which is shown in Fig. 18, have been built something on the order of a gantry crane and carrying an operator at one end. This operator controls both the vertical position of the copper cylinders shown, their revolutions, and the position of the whole affair on the rails which run over the various tanks.

These copper or brass cylinders are about 12 inches in diameter and 20 inches long, and revolve quite rapidly. They form one pole of the electric circuit and the nickel annodes the other. They are first lowered into an iron bath in order to make a deposit so that the later deposits of copper and nickel may be easily removed. They are then lowered and revolve rapidly in the copper solution for a predetermined length of time, when they are raised vertically, the whole crane run over a washing table where the rapidly revolving cylinders are thoroughly washed, and they are then taken to and lowered into the nickel-plating solution for the desired length of time.

In this way they go, receiving alternate layers of copper and nickel, until there are 125 layers of each metal on these cylinders. A vertical cut is then made, which releases this shell, now about 0.007 inch thick, and it is opened

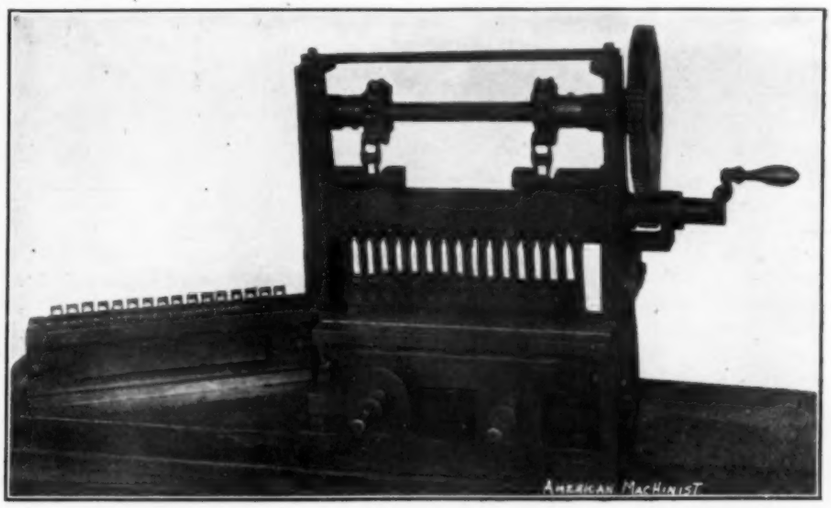


FIG. 15. THE LOADING BLOCK AND THE MANDREL REMOVER

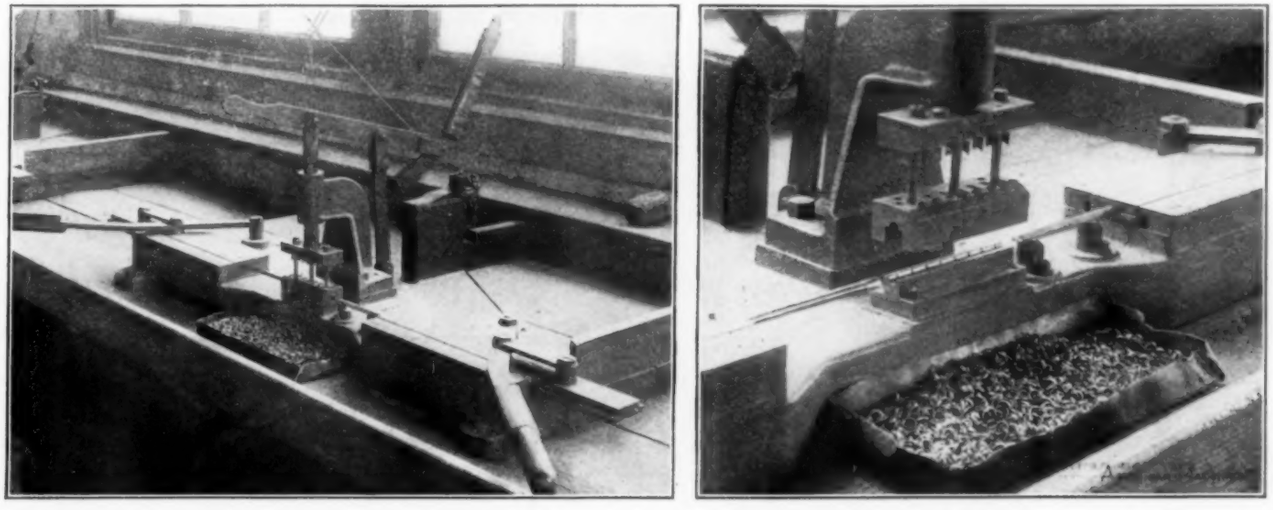


FIG. 14. PUTTING BANDS ON THE POSITIVE TUBES

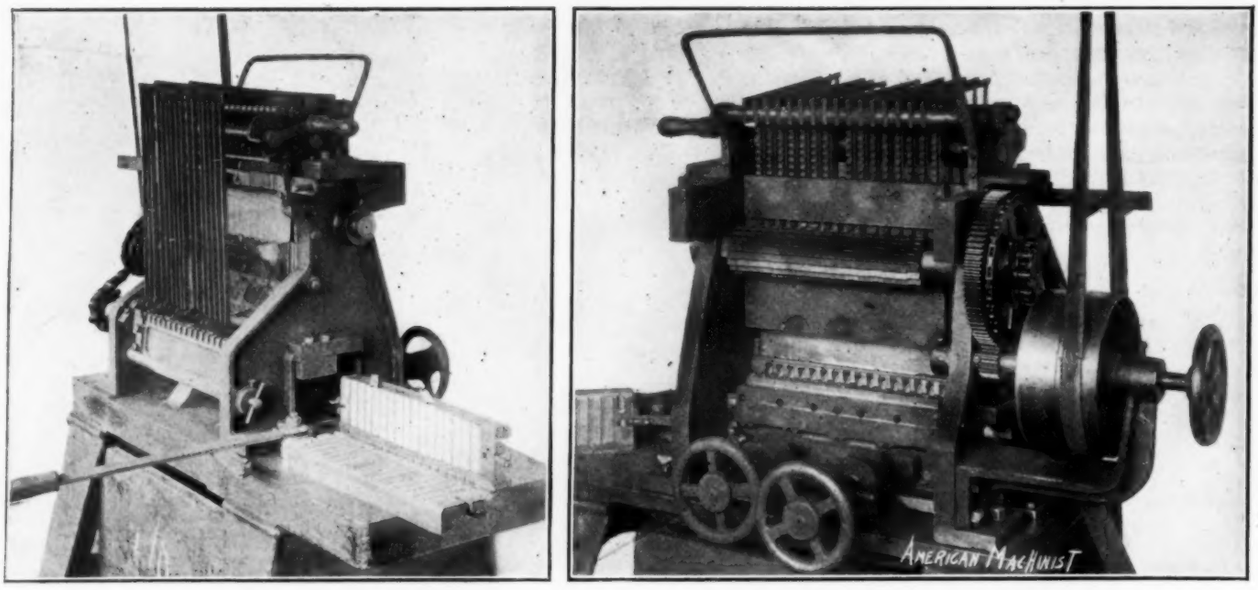


FIG. 16. MACHINE FOR LOADING THE IRON OXIDE

out into a flat sheet ready to be slit and then cut the other way so as to form small squares of about 1/16 inch each.

These are then taken to the recovering tanks shown in Fig. 19, where the layers of copper are eaten out from between the layers of nickel and the deposit of nickel separated into separate flakes, which are so light as to be easily blown about in the air in the same way as a piece of down. The copper is, of course, recovered and used over again.

MAKING THE BATTERY CASES

These are of sheet steel corrugated to increase stiffness and bent up by the simple but effective machine shown in Fig. 20, which can be studied to advantage by anyone having work of this kind to do. From here they go to the side seam welding machine shown in Fig. 21 which uses an oxyacetylene welding nozzle *A* made by the Linde Air Products Company, the body being clamped in the machine so as to bring the seam together and fed under the jet by the motor-driven carriage shown.

From here they go to a sizing press, when a steel block is slipped inside and the whole squeezed in a hydraulic press, which reduces them to the correct size and also puts in the corner indentation, helping to stiffen the cans.

Before going to the machine for welding in the bottoms, the cases go to the little sizing device shown in Fig. 22, the end of the can being set over the pieces *A* and *B* and inside the surrounding frame work, when a pressure on a foot treadle, not shown, pulls the wedge *C* down and forces plates *A* and *B* apart, sizing the opening in the can and preparing it for the welding operation.

A four-part clamp, as shown in place in Fig. 23 is clamped inside the bottom by forcing down the small cross-handled screw in the center. This spreads the four jaws of the clamp and the bottom is set into the case, clamped there by mov-

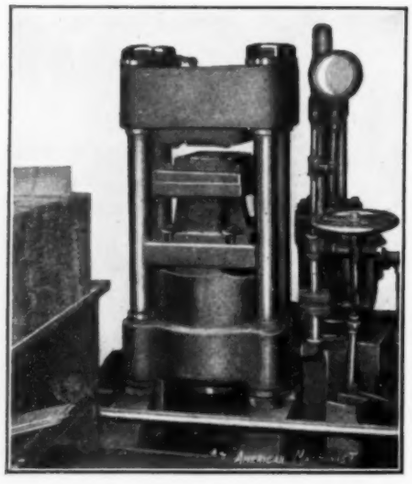


FIG. 17. PRESSING THE TUBES INTO PLACE IN THE GRID

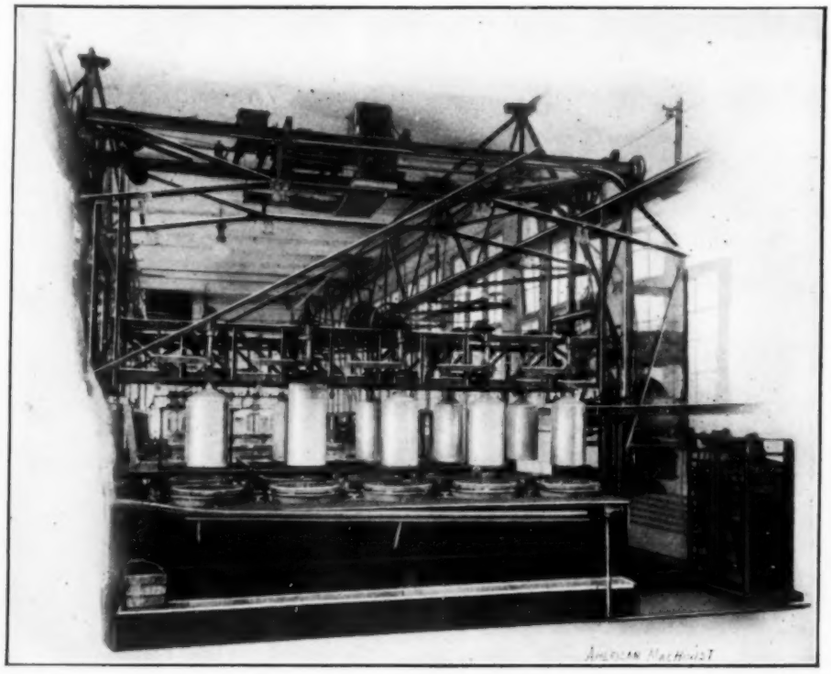


FIG. 18. MACHINE FOR SECURING DEPOSITS OF NICKEL AND COPPER

FIG. 19. DISSOLVING OUT THE COPPER FROM THE NICKEL TO LEAVE THE FLAKE

ing the lever *A* which operates the framework around the outside of the can. The welding nozzle *B* is shown swung down into position for welding, being hinged at *C* so that it can be easily thrown up out of the way while the cans are being changed.

At the same time the welding nozzle is swung down so as to bring the frame in contact with the work, the motor is started, the frame is connected to the motor by throwing the handle *D* which operates the clutch on the shaft of the pinion which meshes into the oblong gear on the bottom of the frame carrying the case.

This moves the frame and the case to be welded along under the welding nozzle until the corner is reached, when the trip *E* throws the small lever *F* and throws the clutch *G* into contact with the upper teeth, increasing the speed of the driving pinion so that the seam being welded moves at the same speed under the nozzle while turning the corner as while being driven along the straight side.

As soon as the corner has been turned the lever *F* is forced down by another trip, out of connection with the upper clutch and the sun-and-planet gearing *I* again comes into play, giving a slow motion as the straight side of the seam travels under the welding nozzle.

For operating this mechanism by hand, in order to bring the seam to be welded to the starting point, the crank *J* underneath is used, this being on the bottom of the pinion shaft.

CUTTING HARD RUBBER FOR INSULATION

Hard-rubber insulating strips separate the positive and negative elements in the battery, these being of different shapes for the different purposes.

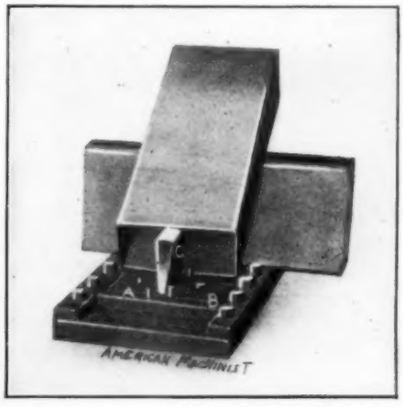


FIG. 22. SIZING THE END OF THE CASE

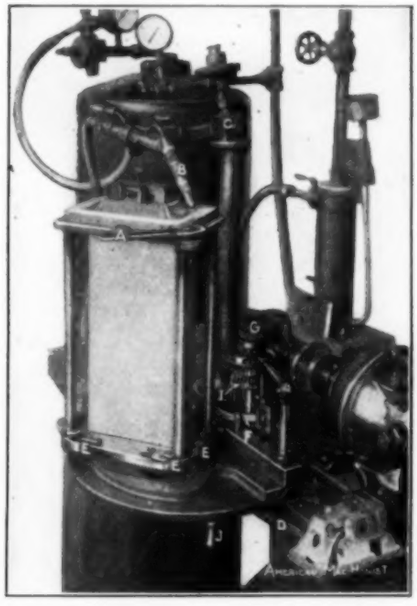


FIG. 23. WELDING IN THE BOTTOM OF THE CANS

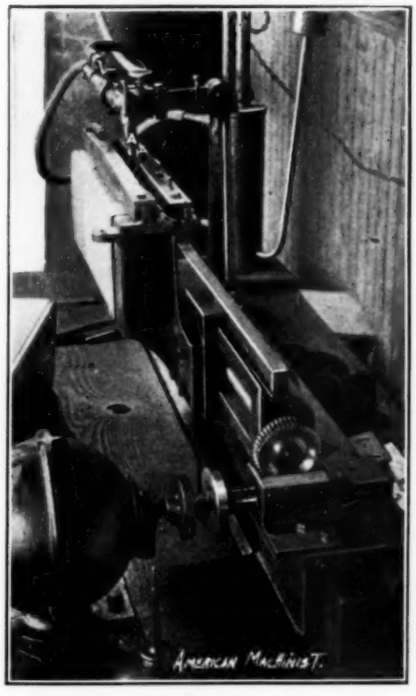


FIG. 21. WELDING THE SIDE SEAM

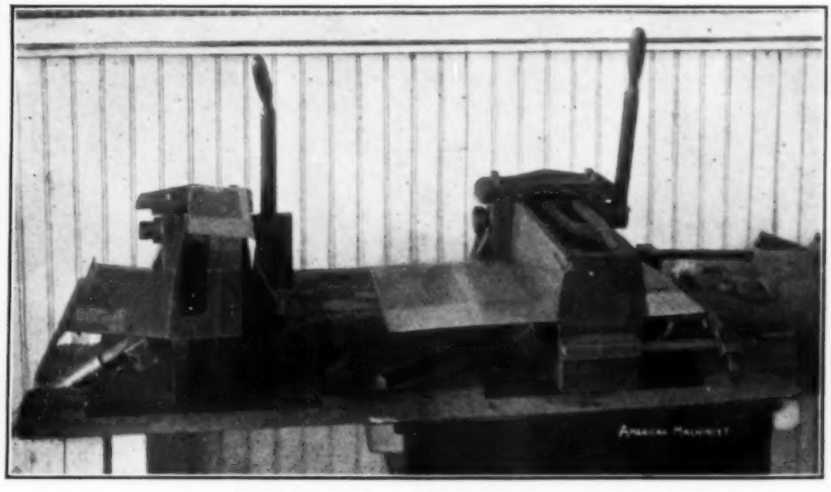


FIG. 20. FORMING THE BATTERY CASES

Some of this rubber comes in corrugated sheets as shown flat on the movable table of the grinding machine in Fig. 24, which makes a very convenient apparatus for any work of this kind. The work to be ground is simply laid on the moving tables against a raised strip on the outside edge and the whole thing pushed along the track in front of the grinding wheels by the handle at the ends. A similar apparatus will be found useful in many other kinds of work.

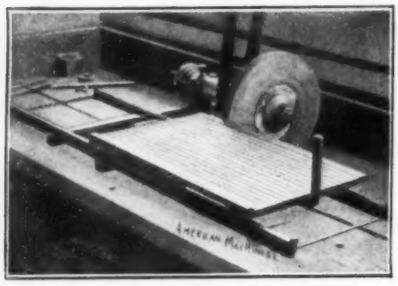


FIG. 24. GRINDING EDGE OF SHEET RUBBER

After these hard-rubber sheets have been ground to the proper width they go to the cutting-off machine shown in Fig. 25 where they are cut up into narrow strips by the machine shown. This is a punch press arranged with a shearing blade *A*. At each stroke of the ram, the sheet moves forward the width of a strip, the feed being by means of the weight *W* acting on the cord which pulls the end piece *E* one notch at each stroke of the press. The rubber sheet lies on a steam-heated table which warms the hard rubber just enough to avoid brittleness and avoid difficulty and wastage in the cutting. Gas heating has been tried for this but the steam has been found the most easily regulated.

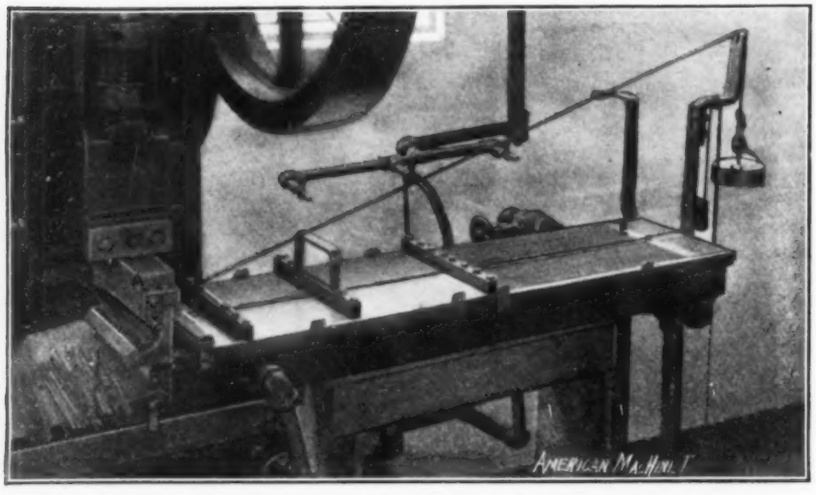


FIG. 25. CUTTING UP HARD RUBBER INSULATION

Examples of Efficient Work

BY C. J. MORRISON*

The proposition to increase the output of a plant by the introduction of scientific management is often met by the objections that the superintendent and foreman have been in the business many years, know all about it, and that the workmen are working so hard that the management would not ask them to work harder. As a general proposition, the men are not asked to work harder, but to work more efficiently. To illustrate the point, consider some very familiar examples.

In the recent boat race at Poughkeepsie the losing Columbia crew, to all appearances, worked harder than the winning Cornellians. One Columbia oarsman collapsed, and the others were "all in," while the Cornell crew was comparatively fresh at the finish. It has been very noticeable in other races that the defeated crew is the one worn out. The reason is that the winners exerted their strength more effectively.

Consider an example that can be seen most any evening; that of the street-lamp lighter. Lamps have been used in the streets for many generations. Thousands of men and boys have been employed as lamp lighters, and, according to the ideas of many, the work of lighting the lamps must be efficient. Here is the process of lamp lighting, as observed in one of the largest cities in the United States only last week.

Considering from pole to pole the operations were as follows:

Place the ladder on shoulder, walk to next pole, place ladder against pole, climb up six (6) steps, turn on gas, get match from pocket, strike match, light lamp, climb down (6) six steps.

The man was working desperately hard, and certainly no one should ask him to work harder, yet all the hard part of his work was unnecessary. The man could light three times as many lamps with far less exertion if he was relieved of the burden of carrying and climbing the ladder. The solution of this problem is so simple that it hardly seems necessary to say: "Give the man a gasolene torch." As this is a city job, it may not be considered desirable to reduce the number of men employed. In that case, why not make the work easier, employ the same number of men, light the lamps in a much shorter time, and save gas? The saving in matches will pay for the gasolene.

Another job, which is probably the oldest of which we have an authentic record, is that of shoveling dirt, yet the efficiency of this operation is usually extremely low. Time studies made on gangs of shovelers in various places have revealed efficiencies of 12 to 25 per cent. The highest ever observed was 38 per cent. and that was an isolated case.

The work of shoveling dirt from piles in the street to a cart, as observed in the same city as the lamp lighting, was as follows:

The horse drawing the cart, who proceeds and stops at command, was stopped with his head opposite the pile to be picked up. Man lifts shovel of dirt, turns around, walks three (3) steps, throws dirt over high front into cart, turns back, walks three (3) steps, lifts another shovelful of dirt, etc. The piles contained, on the average, four shovelfuls of dirt.

In this case, as in many others, the workingman was working very hard, but at a low efficiency. With far less exertion he could perform much more work. The walking, turning and the high lift of the dirt, were all unnecessary, and could easily be eliminated. In addition to this the shovel was of an improper shape for the work, and the handle was too short.

Inefficiencies similar to these can be observed almost anywhere at any time. The application of scientific management in all such cases will not only work easier, but will enable the workmen to increase their earning power. Men will not "work themselves out of a job," because they are able to increase their production capacity. Fortunately, history shows that the amount of work to be done has constantly kept ahead of the labor-saving devices, and there is every reason to believe that it will continue to do so. The progress of almost every successful industry has been toward a steadily decreasing cost of production and a steadily increasing consumption of the product.

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Rev. Dr. Aked tells of a manufacturer who offered to pay his hands for going to church Easter morning. All went. But after the service the foreman said: "Boss, the fellers want me to ask you if we come to church again tonight do we get overtime?"

Making Axles and Transmissions

Editorial Correspondence

The way in which disk grinders, boring machines and millers are used in turning out automobile parts in large quantities.

Special fixtures for grinding, drilling and milling which make rapid work possible.

A method of truing large bevel gears used in the transmission.

Many of the automobiles are using rear-axle housings made of sheet steel, pressed up in two parts and either riveted or welded by some of the autogenous processes. The way these are handled by the Metal Products Company, of Detroit, Mich., is shown in the accompanying illustrations.

The first operation is to grind the ends and the sides around the center opening, which is done on disk grinders, as shown in Fig. 1. The axle housing is held in the fixture shown at the right, so that the flange is ground square by the disk grinder shown. The whole housing is then swung in two hooks, as shown at the left and the sides trued up by the disk grinder on the left.

The large center opening is bored out to size by a large swinging cutter on the order of a flue-sheet cutter of large size.

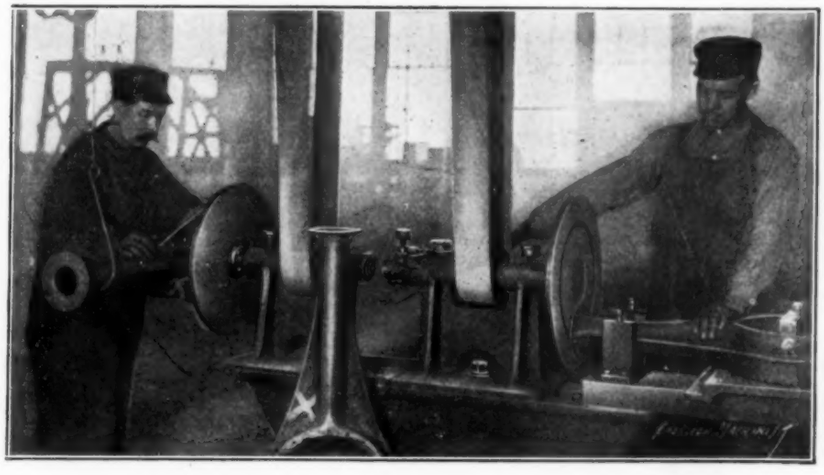


FIG. 1. GRINDING ENDS AND SIDES OF REAR-AXLE HOUSINGS

MULTIPLE DRILLS IN A BORING MACHINE

They then go to the Lucas horizontal boring machine, shown in Fig. 2, which is equipped with a special auxiliary spindle and support, in front of the main head and spindle. This auxiliary head carries 10 drilling spindles, so that all holes in the end are drilled at one operation. Then the whole fixture is swung around on a center bearing so as to bring the other end in line with the multiple drilling head, the whole operation requiring very little time.

FIG. 4. PORTABLE RIVETER FOR WHEEL BEARINGS

From here it goes to the multiple driller shown in Fig. 3, where all

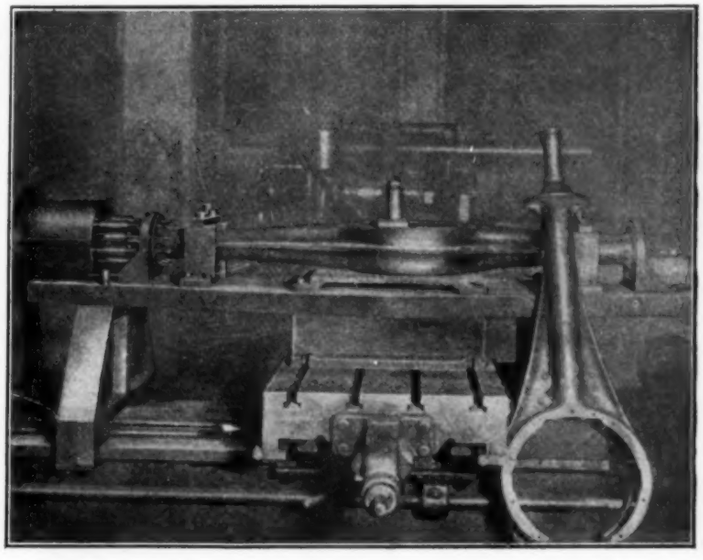


FIG. 2. BORING MACHINE EQUIPPED WITH AUXILIARY HEAD CARRYING 10 DRILLING SPINDLES

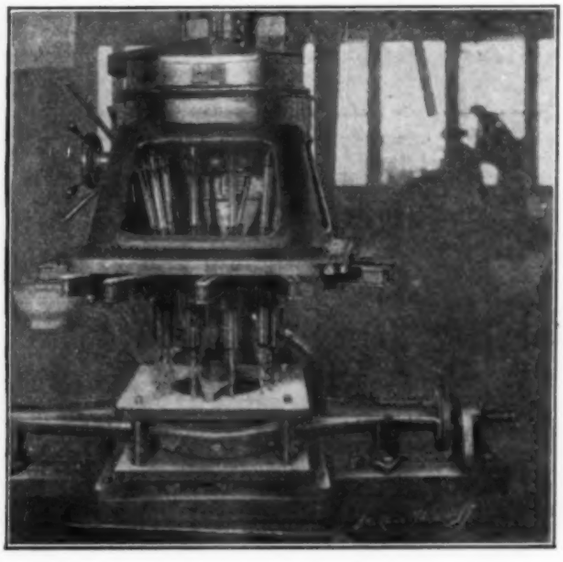


FIG. 3. MULTIPLE DRILLER FOR DRILLING HOLES IN FLANGE OF CENTER OPENING

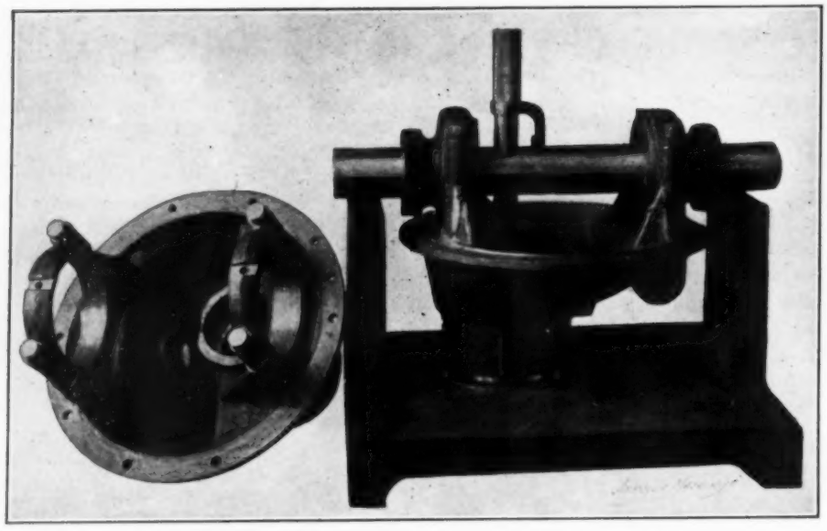


FIG. 5. DIFFERENTIAL HOUSING AND METHOD OF SECURING ALINEMENT

the holes are drilled in the flange of the center opening. The drilling fixture is arranged so that the housing can be quickly reversed and the other side drilled in a very similar manner.

rear-axle housing. The flanges are squared up so well on the disk grinders that the two wheel bearings are usually found to be in excellent alinement after both are riveted in place, and they

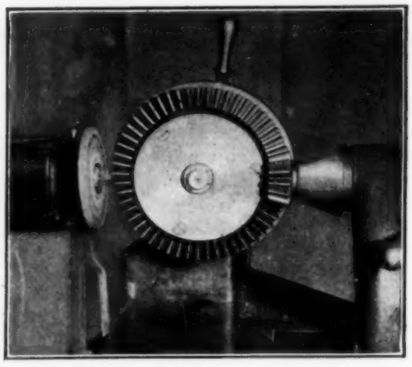


FIG. 8. EQUALIZING PLATE FOR LARGE GEARS

exactly in line, a very little peening is all that is necessary to bring them into correct position.

THE DIFFERENTIAL HOUSING

The differential housing is shown in Fig. 5, as well as the way in which alinement is secured, so that everything will be perfectly square when it is riveted in place on the rear-axle housing. One of the completed housings in shown lean-

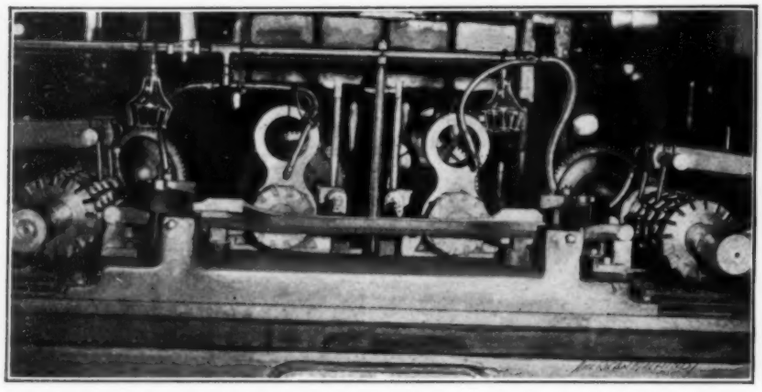


FIG. 6. FRONT AXLE IN PLACE ON SPECIAL FOUR-HEADED MILLER

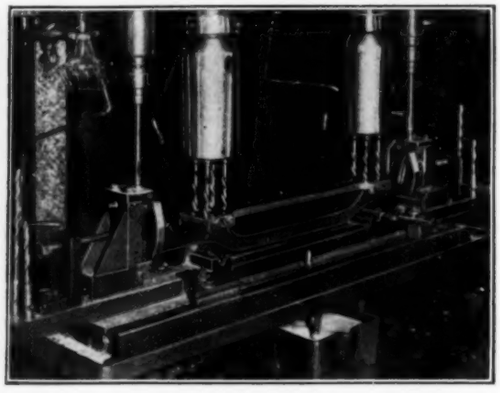


FIG. 7. DRILLING FRONT AXLES ON FOUR-SPINDLE DRILLER

Then the wheel bearings are riveted on to the end flanges, shown in Fig. 4, by a portable riveter, which makes a very rigid

have been put on the testing fixture to be sure that they are correct in every particular. If it is found that they are not

ing against the left end of the fixture, while the way in which it is tested for accuracy is shown at the right. These housings are carefully bored in special fix-

FIG. 9. TWO PLAIN MILLERS EQUIPPED WITH SPECIAL MULTIPLE-INDEXING FIXTURES

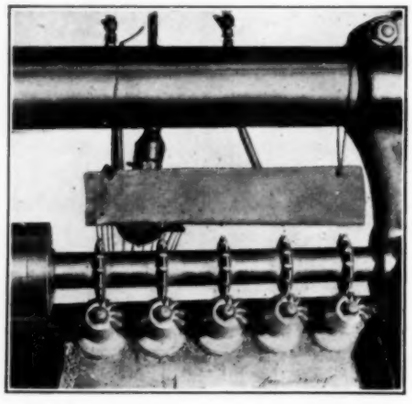


FIG. 10. SPECIAL MILLING FIXTURE FOR HANDLING FIVE PINIONS

tures so that the holes will be of exact right angles and in correct position so that the live axle will come central in the compressed-steel housing.

As shown, the housing is placed on a bushing in the bottom of the fixture and the horizontal testing bar put through, which represents the bearings of the two halves of the live axle. Through this bar, in its proper position, is the vertical bar which represents the driving shaft from the motor. The vertical bar goes through a hole at exact right angles to the horizontal bar and into a bushing, which fits the hole made for the driving shaft. The arm shown on the vertical rod locates its distance from the face of the housing, and tests both for the location of the driving-rod hole and the distance of the center of the axle bearings from the face of the housing which fits the axle housing.

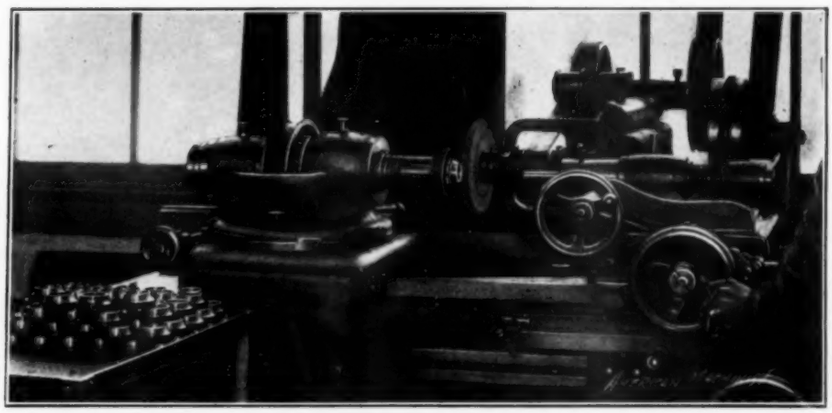


FIG. 11. SPECIAL ATTACHMENT TO AN INTERNAL GRINDER

FRONT AXLES

Two special machines are used in making up the front axles after the forgings are received.

Fig. 6 shows one of these axles in place on a special four-headed miller, built by Beaman & Smith Company, Providence, R. I. The two center heads are milling the pads for the spring seats, while the heads at each end are milling all four surfaces of the forked end to accommodate the steering knuckle. As will be seen, overarms are provided both for the end milling cutters and for the two center spindles, should it be found desirable to use them on other classes of work.

Fig. 7 shows how these axles are drilled, under a four-spindle driller made for this work, the two center spindles having auxiliary heads carrying four drills each, so that all four holes are drilled in each spring pad at one operation. At the same time the holes are being drilled in the gears for the steering knuckles. This also shows the fixtures used in holding the axles for this work.

TRANSMISSION GEARS AND PINIONS

One of the problems of automobile builders is to keep the large bevel gear of the transmission so that it will run evenly with the pinion after hardening. On account of its large size and the comparatively small amount of metal it contains, it is almost sure to spring during the heat treatment, so that it bears unevenly on the pinions where they are run together.

In order to equalize this as much as possible, this company mounts the large gears on a plate, as shown in Fig. 8, and tests it with a pinion on one of the Gleason bevel-gear testing machines. The large gear is adjusted with reference to its face, until it runs freely with the bevel pinion, regardless of the turned surface on the back of the large gear.

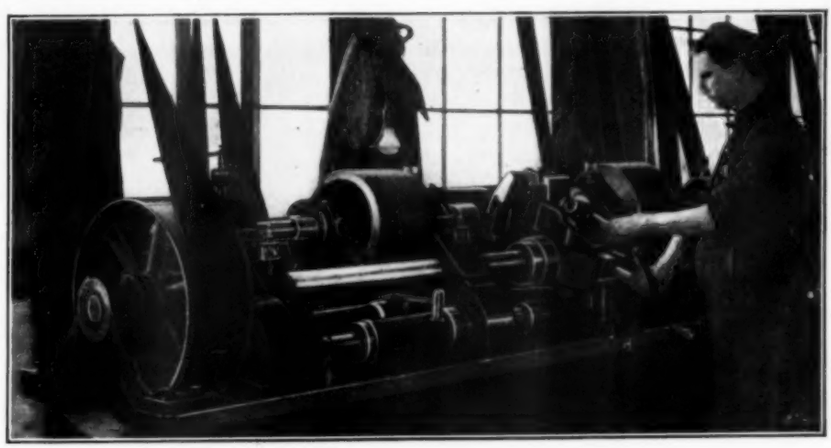


FIG. 12. MACHINING STEERING KNUCKLES IN DOUBLE-SPINDLE AUTOMATIC

When it is adjusted to its best running position, it is revolved slowly in the narrow surface ground on the inner end of the top of the teeth by the portable grinder, shown mounted on the machine. This grinds a narrow flat surface on the inner end of the case, which is true with the gear in its best running position. The gear is then removed and the surface, which has been ground, is used for locating the gear for the finish grinding of the surface back of the teeth where it is mounted on the flange of the differential driving case. This method gives very good results and seems to be one of the most practical methods of dealing with this problem.

MULTIPLE-PINION CUTTING

Figs. 9 and 10 show the way in which the bevel pinions are roughed out before being planed on the Gleason bevel-gear planer. Fig. 9 shows two Kearney & Trecker plain millers, equipped with special multiple indexing fixtures for roughing out four or five bevel pinion blanks at one operation. These are all geared together so as to index uniformly with one movement of the indexing handle.

Fig. 10 shows a close view of the fixture arranged for five. This shows the five-stocking cutter at work on as many pinions, and it is also the way in which cutting lubricant is fed to all five cutters. A sort of deep pan is suspended from the overarm, the lubricant being fed into it by the two flexible oil pipes shown. An opening punched in the bottom of this pan over each cutter delivers the lubricant directly at the desired point and makes a very simple method.

AN ATTACHMENT TO AN INTERNAL GRINDER

Fig. 11 shows an interesting attachment to a Heald internal grinder. Without disturbing the regular grinding head an auxiliary grinding spindle has been mounted at the end of a substantial cross slide, which is arranged vertically, as can be seen behind the nose of the internal spindle bearing.

This auxiliary grinding spindle carries a good-sized wheel and is used on external work of any kind desired, which is within the capacity of the machine.

In this particular case the adjusting cones for ball bearings are being ground by having the grinding wheel turned to the desired form of the ball race. The wheel is driven by ample belt power for any other work. With this combination both the inside and outside of these ball races can be ground at the same setting, which insures their being absolutely true

with each other. The grinding attachment at the rear does not interfere in any way with the internal spindle, and has been found very useful on many classes of work.

Making Steering Knuckles

Fig. 12 shows one of the large double-spindle automatics of Prentice & Co., at work on steering knuckles. The knuckles are held in the central chuck with operating spindles on each side, as is peculiar to this type of machine. In the illustration, the operator is just putting a new piece into the chuck, while those which are already in place are being operated on by the various spindles, as they come into action. The convenience of holding the odd-shaped pieces in this type of machine, makes it peculiarly adapted for some classes of automobile work, as in this case. We are indebted to Mr. Evans, of the Metal Products Company, for the illustrations and information in regard to their methods.

Systematizing Business Correspondence

By Oscar E. Perrigo

When the mechanical engineer takes up the consideration of a subject he does so in a methodical manner. He first examines the conditions, then analyzes and classifies them. From this analysis he determines the requirements of the subject. Then he proceeds to formulate a plan that shall meet those requirements, always keeping in mind that simplicity is the keynote of system and efficiency its objective.

To secure efficiency plans must be so formulated as to reduce labor, whether mental or physical, to its lowest practicable point consistent with the accomplishment of the prime object.

This is the process employed in the matter of systematizing correspondence, resulting in the following system for attaining results in a practical manner.

The conditions are: A large manufacturing plant making a popular machine which is extensively advertised. The sales manager receives a very large number of inquiries in regard to the machine, which must be treated with courtesy, yet in such a forceful and convincing manner as to produce orders for the machines.

While all inquirers may not be prospective buyers, the percentage of orders will depend very largely upon the ability of the sales manager and his corresponding clerks, and the character of the letters sent out in reply to these inquiries.

Naturally, one man cannot do all of this work. Hence, the inquiries should be read, sorted, classified and assigned to the different persons best fitted to handle each one. Or, the territory covered may be divided geographically and a certain section assigned to each corresponding clerk.

It is quite true that no man, however well he may understand the art of writing convincing letters, can succeed as well with a new subject, relating to a new machine, during the first few months as he can later. His experience along these lines will be valuable, hence, it should be methodical, in order to produce the best results.

In commencing a campaign of this sort the sales manager will usually dictate letters himself, giving to each as much of the character of an individual reply as may be, but always keeping in mind the requirements noted above.

Another point that should not be lost sight of is that most men will write much better on some days than on others; ideas seem to suggest themselves much more readily, and new ideas that fit the occasion and enable them to express what is intended in a much more forceful and convincing manner. Sometimes it seems much easier to convince the prospective customer that it will be greatly to his interest to buy what we have to sell, and preferably to buy *our* goods than those of our competitor; to stimulate the desire to *give* an order, to give it to *us* and to give it to us *now*. This is the purpose, the *objective* always to be kept in mind as the culmination of all our efforts in a correspondence and follow-up system.

Long before he has completed his first hundred letters he will find himself falling into stereotyped phrases and getting into a mental rut that will be anything but progressive. He should continually seek to better the *tone* and *form* of his letters. Still the several paragraphs composing a letter will naturally fall into some one of the following classes, viz.: (1) Opening, (2) description, (3) design and construction, (4) price and terms, (5) special advantages, (6) inducements to order, (7) guarantee, (8) testing and demonstration, (9) references, (10) closing.

An extra carbon copy of each of these letters should be made and later on cut up into paragraphs. These paragraphs should be classified as above, and those of each class thoroughly examined and their phraseology carefully considered and improved, if possible. Such paragraphs in each class as appear to be the clearest, strongest and most likely to favorably impress the inquirer should be pasted upon letter sheets of quite thick, stiff paper and numbered, first with the class and then the serial number of the class. For instance, those of the first class, "Opening" paragraphs will be numbered 1-1, 1-2, etc. These paragraphs will read somewhat like the following:

"We have your letter of . . . . and in response to your inquiry are inclosing you . . . . which will give you the information desired."

"We have just received your inquiry of . . . . and in response to the same we ask your attention to the following facts in relation to our machines."

Such paragraphs will be followed by those relating to the description, design, construction, etc., or such other classes of paragraphs as seem necessary and advisable to fully reply to the inquiries received.

When all these sheets of paragraphs have been made up copies of them will be made for the use of the stenographers, using the same designating numbers as above indicated.

In using them there is no necessity of dictation to the stenographer, but with the classified paragraph sheets at hand, it is only necessary to write a series of numbers across the bottom of the inquirer's letter, something like the following:

1-2, 3-7, 4-2, 6-3, 7-1, 9-8, 10-3

The stenographer will very readily make up a letter of the paragraphs indicated.

Occasionally it may be necessary to write a special sentence or paragraph, but this will seldom occur in the regular routine business. However, copies of such paragraphs should be preserved and pasted on a sheet marked "Special," and numbered serially. When one of these paragraphs is required in a letter its number will be given, preceded by a letter S. As time goes on it may be found advisable to drop out some of the paragraphs originally prepared and substitute others which seem to answer the purpose better; but generally from five to ten paragraphs in each class will be found sufficient for practical work.

This system is very simple both for the corresponding official and the stenographer, and it will save about 75 per cent. of the time of the former and 50 per cent. of the latter.

As to the practical utility of the system the following facts are presented. I inaugurated this system nearly two years ago, in a business in which there was a considerable volume of correspondence to be taken care of.

The result at the end of one year and eleven months has been, that, for the last month eight times the number of orders have been received, per hundred inquiries, as during the first month of its use. It is not claimed that this great gain is due entirely to the system. It is plain that the corresponding official has improved in his knowledge of the business and the quality of his work, but a considerable degree of this improvement is undoubtedly due to the system.

Another point that should not be forgotten is that in the use of this system a man may readily handle from three to four times the number of letters per day, that he could by dictating each letter to a stenographer.

High-speed Spiral Gearing—I

By Albert E. Guy *

An analysis of the tooth action of a spiral pinion and its mating gear laid out according to the usual normal pitch method. Slippage and loss of tooth contact are shown if the motion is assumed uniform. If contact is assumed the motion cannot be uniform but the driven tooth must accelerate from the beginning of its contact.

*Consulting engineer, Trenton, N. J.

A little less than two years ago there came from East Pittsburg, Penn., the startling announcement that a machine had been designed, constructed and tested at the works of the Westinghouse Machine Company, in which 6000 brake horsepower from a steam turbine running at 1500 revolutions per minute, was transmitted by means of one single reduction gear to the shaft of a hydraulic dynamometer running at 300 revolutions per minute.† The efficiency of the reduction gear was found by careful test to be 98.5 per cent.

Prior to this development the general aversion to the use of gearing in power transmission and particularly with high speeds, prevented the taking reduction gears into serious consideration as common auxiliaries. This aversion was apparently quite well founded, for the mere mention of gearing would bring to the mind of the engineer disagreeable recollections of pounding and noise. In fact, in many minds, gearing and noise were almost synonymous. What was considered up to that time as bordering on the extreme of engineering daring was the gear reduction which alone rendered available as a prime mover the splendid conception of Doctor De Laval. The largest size of the standard De Laval type of gear turbine is of 450 horsepower. The turbine-driven pinion shaft runs at about 10,600 revolutions per minute; it engages two large gears, each running at 750 revolutions per minute, the shafts of which drive electric generators or centrifugal pumps. These gears are of the spiral type, with the teeth hobbed in the conventional way, which is based on the consideration of what is known as the normal pitch.

I had the good fortune to witness the performance of the Westinghouse machine under the guidance of the designer of the reduction gear, Mr. McAlpine. Quite contrarily to all expectations, instead of the anticipated high-pitched, shattering and nerve-racking noise, I experienced an agreeable surprise in hearing, but a low rumbling sound, which did not interfere with the carrying on of conversation in an ordinary tone of voice between persons standing about three feet away from the gear casing. The machine performed splendidly, was free from vibrations, and with the floating frame actually floating in good fashion. An examination of the surfaces of the teeth revealed a healthy gloss, indicative of perfect contact on the whole length of each tooth. As the machine runs only in one direction it was easy to distinguish the driving side of the tooth from the back or idle side.

After such an experience the observer must, perforce, carry away the deep impression that correct designing and perfect workmanship have produced an apparatus destined to be epoch making; a prototype of excellence, opening a vista of possibilities heretofore thought impracticable. The most beautiful part of the achievement is after all that it was not done with a special brand of magical absorber of noise and vibration, but instead, it was due to the clear conception of mechanics so well possessed by the designer.

The gearing is composed in its simplest form of a pinion and a wheel mounted on parallel shafts. Viewed on end, that is, on a plane normal to the axis, the gears appear to be of the spur type. But lengthwise they are seen to be twisted uniformly from one end to the other. Their most benefitting description is, perhaps, that they are twisted spur gears.

Were it not that the so called spiral gears possess some distinct advantages over the spur gears, any one pair of spirals could be replaced by another pair of

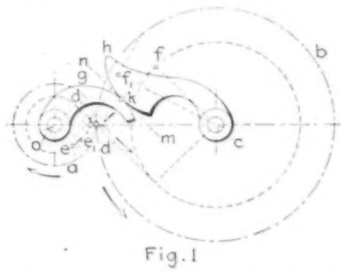


Fig. 1

DIAGRAM OF INVOLUTE TOOTH ACTION

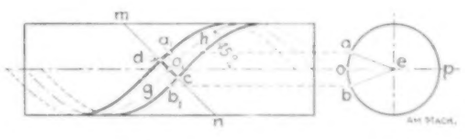


Fig. 2 Fig. 3

DIAGRAMS SHOWING THE RELATION OF CIRCULAR NORMAL PITCHES

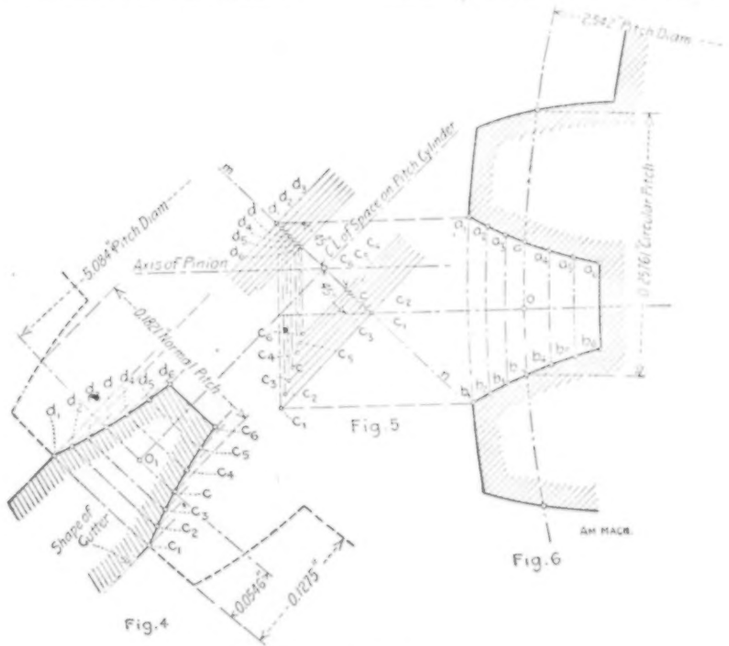


Fig. 4 Fig. 5 Fig. 6

TOOTH PROFILES NORMAL TO AXIS

†AMERICAN MACHINIST, Volume 33, Part 1, page 49.

spurs of the same size, the gear action proper would be precisely the same in one case as in the other. However, the very fact that the gears were twisted led to a conception of them as belonging to a special class, and this conception was strengthened by the other fact that spiral gears were used extensively with the shafts angled one to the other, anywhere from zero to 90 degrees, instead of being parallel.

The Requisites of Gearing

Barring exceptional cases the requisites of gearing are the transmission of power:

(a) At a uniform rate of speed,
(b) Efficiently,
(c) Noiselessly.

The condition of constant speed is met by the proper shaping of the teeth, so that, when any two gears, Fig. 1, of pitch radii $o\,d$ and $c\,d$, with a fixed center distance $o\,c$, are in mesh, they rotate as shown by the arrows with the same circumferential displacement.

The shape of one side of each tooth in contact may be represented by the templets g and h. These templets are in contact at the point k, where it is found that $m\,n$ is the tangent common to both curves, and $e\,f$ is the common normal.

If the shapes are correct the contact will take place always on line $e\,f$, whose position thus becomes fixed and the curves will roll one upon the other without slipping. Now, drawing the normals cf and $e\,o$ to $e\,f$, we may write the relation:

$$\frac{od}{cd} = \frac{eo}{cf} = constant.$$

The radii $e\,o$ and $c\,f$ are then virtually those of pulleys connected by a crossed belt, so that for a given speed of the belt the peripheral velocity of the point f is the same as that of point e, while simultaneously the peripheral velocity of the circumference b is the same as that of a.

It is quite obvious that if during the engagement of one tooth the direction of contact was displaced so as to coincide at a given time with the line $e\,f$, for instance, the velocity ratio between the two wheels would be altered, for we would then have

$$\frac{cd}{cd} > \frac{od_1}{cd_1} \text{ and consequently } \frac{oe}{cf} > \frac{oe_1}{cf_1}.$$

If the line of contact $e\,f$ was pivoted about point d during the passage of one tooth, so that the angle $c\,d\,f$ be varied according to a given law, it could be easily shown that the curve of the tooth could be made to suit that law, the speed ratio remaining constant. Thus, an infinity of curves may be used for the tooth. But if the condition is imposed that the position of $e\,f$ is fixed, angle $c\,d\,f$ becomes constant and the suitable curve is the involute of a circle. In Fig. 1, $k\,h$ is the involute of a base circle of radius $c\,f$. This curve is suitable for one side of a tooth on the wheel b. Likewise, $k\,g$ is the involute of the base circle $e\,o$, and is suitable for the side of a tooth on the wheel a. The involute shape is the most used in practice, but the angle of pressure has not been standardized, it ranges in practice from 14½ to 25 degrees. Its common value is 14½ degrees. This value will be used in the present analysis.

Normal and Circular Pitch

Let $a\,b$, Fig. 3, be the *circular pitch*; that is, the center distance of two consecutive teeth of a spur gear, measured on the pitch circle of radius $a\,e$. If this gear is now twisted uniformly it will become spiral shaped. On a plane normal to the axis, Fig. 2, the distance $a\,b$, will be the exact projection of the circular pitch, and the two threads passing, respectively, through these points will be the center lines of the two consecutive teeth. It is sufficiently correct to assume that the line $c\,d$, normal to the median $g\,h$, measures the normal distance between the two center lines. This line $c\,d$ is called the *normal pitch*.

In the kind of spiral gears we are now dealing with, the question is not settled as to whether to base the form of the teeth on the consideration of the circular pitch or on that of the normal pitch. When occasionally spiral gears are to be made to suit ordinary conditions of practice, the cheapest and most expedient way is to consider the normal pitch, since an approximate form of milling cutter may be used, which is a standard tool for spur-gear work, and is usually carried in stock by dealers. But when spiral gears form parts of machines of standard manufacture, and principally so when the speeds used are very high, noise being then objectionable, the gears should be cut to suit the circular pitch. If we once fix in our mind that two spiral gears mounted on parallel shafts are, when viewed axially, working together exactly like spur gears and that they are, in fact, but twisted spurs, then we cannot entertain any doubt as to the conditions these gears must meet. They must rotate at a uniform rate of speed as measured on the pitch circumference; between any two teeth in a normal plane there must be a rolling contact from the beginning to the end of the arc of action; the normal to one tooth curve at the constant point must also be normal to the other tooth curve, otherwise there would be a tendency to slip or an actual slip could take place, thus altering the speed ratio of the two gears.

To select the normal pitch as a basis means that when a templet, made to suit the space between two consecutive teeth whose circular pitch would equal the normal pitch $c\,d$, is located on the plane $m\,n$, with its center line passing through o, Fig. 2, it must contact exactly with the sides of the two teeth whose centers are on the spirals $b\,c$ and $a\,d$. It is claimed by some gear makers that, for instance: "The action between spiral teeth is not upon the axial section, and it is not that of a rack and gear, but when *there is any action at all* it is upon the normal spiral section." (From page 53 of the George B. Grant's "Treatise on Gear Wheels.") This statement is somewhat upset by another on the following page, which reads in part: "But, although the action of spiral-gear teeth is intermittent, and their contact is *theoretically perfect at one instant only, when they are passing the common normal,* they are nearly in contact all the time and the action is practically perfect . . . ."

If the action took place upon the normal spiral section, that is, along $c\,d$, it is easily seen that such action would be imperfect; slipping would occur and the speed ratio would not be uniform. The helix angles of the tooth at the top, pitch line and root are different for a given normal section. Assuming, for illustration, these to be, respectively, 47 degrees, 45 degrees and 43 degrees, then, when contacting with the tooth on the other wheel, the top of one tooth with a 47-degree angle would contact with the bottom of the other having a 43-degree angle. Such a contact would be very bad. It is only when the contact would take place on the pitch line, where the angle of 45 degrees is common to both teeth, that the action would be correct.

Wrong Shape Generated by Normal Pitch Cut

To show the results obtained with a gear cut on the normal pitch basis, let us select as an example the pinion of an actual high-speed machine, transmitting 300 horsepower at 10,600 revolutions per minute to two gears whose axes are parallel with the pinion strap.

The pitch diameter is 2.542 inches; outside diameter, 2.6513 inches; total depth of tooth, 0.1275 inch; circular pitch, 0.25761 inch; angle of pitch spiral or helix, 45 degrees; normal pitch, 0.18216 inch; number of teeth, 31.

The drawings of this gear were made 15 times the real size so as to more easily show the contour of the teeth. The angle of pressure is 14½ degrees.

A section through a cylinder along the plane $m\,n$, Fig. 2, would determine a plane whose contour line is an ellipse. The major axis is $m\,n$ and the minor axis $o\,p$. The normal pitch templet is fitted at o_1 end of the minor axis, hence we may conceive that for a short distance the elliptic arc at o_1 coincides with an arc of a circle of radius equal to the radius of curvature of the ellipse at that point.

This radius is given by the equation:

$$r = \frac{A_2}{B},$$

in which

$$A = \frac{\text{major axis}}{2} \text{ and } B = \frac{\text{minor axis}}{2} = \frac{\text{pitch diameter}}{2}.$$

In this case with the helix angle = 45 degrees,

$$A = \frac{\text{pitch diameter}}{2 \times \cos. 45^\circ} = \frac{\text{pitch diameter}}{2\sqrt{2}}.$$

Hence

$$r = \left(\frac{\text{pitch diameter}}{2\sqrt{2}}\right)^2 \frac{1}{\left(\frac{\text{pitch diameter}}{2}\right)} = \text{pitch diameter}.$$

remembered that only the helices passing through points c and d are inclined at 45 degrees to the axis of the gear. Those above the pitch circle are at greater angles, and those below at lesser angles.

Now, in Fig. 5, let a plane normal to the axis pass through each intersection c_1, c_2, c_3, etc., these will determine the intercepts $c_1 d_1$, $c_2 d_2$, etc. The intercept $c\,d$ is the circular pitch and is transferred to its proper place on Fig. 6. It should be noted that, in this particular case, the curvature of the arcs of circles or of helices is so slight for each length thereof utilized that it is not taken into account, and the said arcs have been projected as straight lines. The other intercepts are now *transferred* to Fig. 6 and through the points a_1, a_2, a_3, etc., thus obtained, contour lines are drawn which represent the exact shape of the space and tooth as viewed on a plane normal to the axis.

That this method is correct was proved by comparing a photograph of the drawing reduced to the actual size with the section of a newly cut pinion. The coincidence was extremely close.

The fillets at the root of the tooth are not shown because they are useless for the purposes of this discussion.

The shape obtained is *apparently* correct and it is obvious that the tooth is very strong. But this is an instance when appearances are not to be trusted, and we will proceed at once to test the accuracy of the working part of the tooth contour. The easiest way for so doing is to take two such pinions, cut one right and one left hand, to place them in contact on the pitch circle with the axes parallel, and to cause them to rotate at a uniform rate of speed, so that one turn of the one will correspond rigorously with one turn of the other, and furthermore, that any slight angular displacement of the one will correspond to a precisely equal displacement of the other. Thus, in Fig. 7, a and b represent portions of the pitch circles of the two pinions. These arcs are both graduated with divisions of equal length. Curves c and d are profiles of teeth at the beginning of engagement. These profiles are also equally graduated, the graduations starting at the first point of contact. The direction of rotation is shown by the arrows.

Fig. 8 shows the relative positions of the profiles after a slight simultaneous rotation of the two pinions. We observe

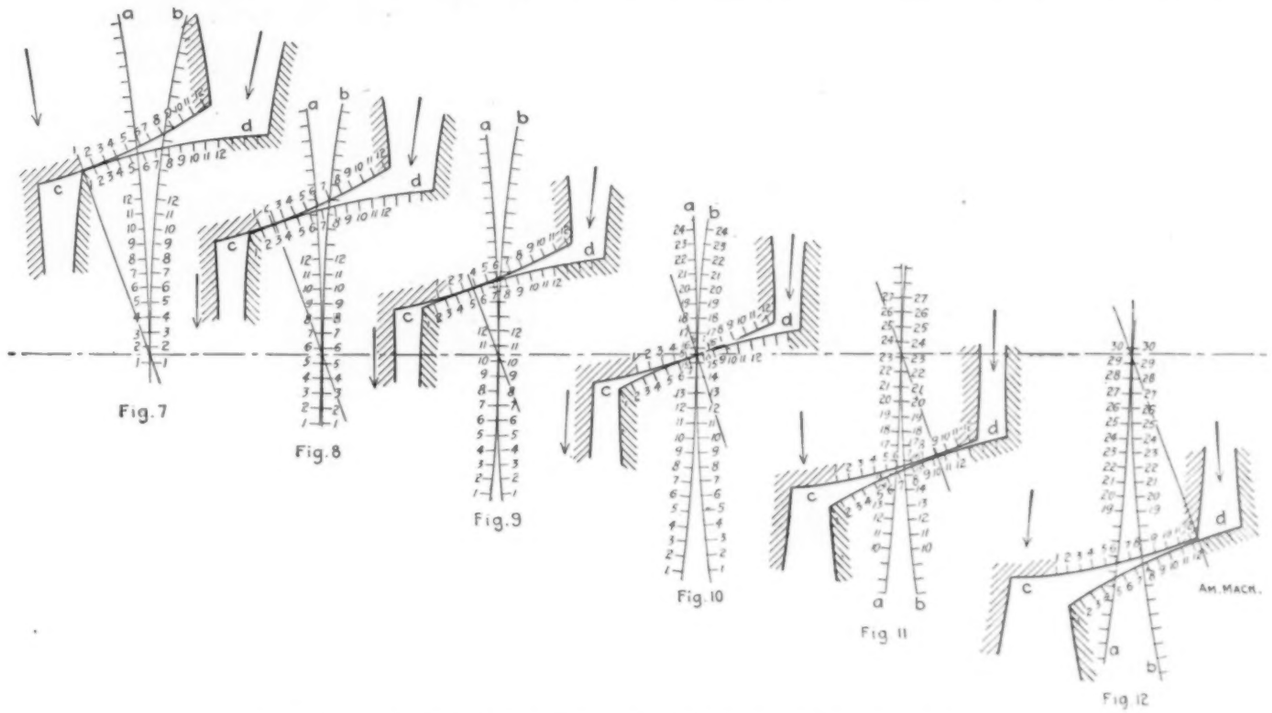


Fig. 7 Fig. 8 Fig. 9 Fig. 10 Fig. 11 Fig. 12

GRAPHICAL ANALYSIS OF TOOTH ACTION LAID OUT BY NORMAL PITCH METHOD

With a circumference of radius $r =$ 2.542 inches and a pitch of 0.17216 inch the number of teeth would be

$$\frac{2 \times 3.1416 \times 2.542}{0.18216} = 87.67, \text{ say } 88.$$

In Fig. 4, the shape of the milling cutter is shown as determined accurately by means of the above data, the flank of the tooth being an involute drawn in the usual way. Assuming now that the gear has been cut with this tool, the question is to find the shape produced on a section normal to the axis.

Divide the addendum and the dedendum each into 3 parts and draw the arcs of circle $c_1 d_1$, $c_2 d_2$, $c_3 d_3$, etc., Fig. 4. Then project the points c_1, c_2, c_3, etc., on the normal $m\,n$, Fig. 5. Through the intersections thus obtained draw portions of the helices on which the points c_1, c_2, c_3, etc., in Fig. 4 are located. It should be

the coincidence of the divisions on the pitch circles, but we see at once that one of the profiles has slipped over the other so that the profile graduations do not coincide.

Fig. 9 shows further slippage, graduation 1 on c being nearly opposite 2½ on d.

In Fig. 10 something worse happens, the slippage has still increased, and in addition the profiles have lost contact. (The original drawing of this figure clearly showed the loss of contact but unfortunately this was not shown in engraving reproduction).

In Figs. 11 and 12 the slippage gradually diminishes but the gap between the profiles has increased.

These profiles do not meet the requirements for gearing; the contact is not the rolling one, almost frictionless, expected;

instead, when it occurs there is slippage, producing friction and consequent heat; and in order to insure even such a contact on the whole face of the tooth there must be inharmonious rotations of the two pinions. In other words, in order to catch up with its mate one tooth must accelerate its motion from the beginning of contact to the end. The net result of this situation is that unless the pinions are ground before use rapid wear and intense vibrations are sure to take place, principally so with high speeds of rotation.

The question arises then as to why so much accuracy was aimed at when cutting the teeth, since a blind process has to be finally resorted to to rectify the incorrect shape obtained by the first operation. The necessary grinding is not a small matter either, because for a gear of the kind just analyzed, usually made of the herring-bone type to equalize the thrust three soft-steel dummy pinions are generally used up for each set of gears before the gear expert pronounces the work perfect. Then everybody is happy until the finished machine reaches the test blocks. There, the vibrations observed may be of such intensity as to require the gears to be either slightly recut or else reground, or again nothing availing a stock pinion may be used instead of the one made specially to suit the very gears in the machine. The funny part of the story is that this stock pinion, which now plays so well the role of pacifier, may have proved extremely unruly when tried along with the gears it was made to suit.

Yet They Run and Last

The defects we have just brought to light must exist to some degree in all spiral gearing cut on the normal pitch basis, and still such gearing is remarkable for its smoothness of action and its durability. With high speeds noise is, of course, produced, but apart from that many gears are now in use which have been in constant operation for more than seven years. It seems at first somewhat difficult to reconcile this fact with the defects observed, which, had they existed in ordinary spur gearing would have had a very destructive effect.

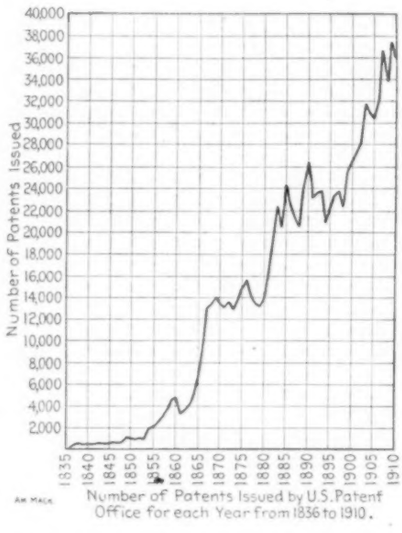
There are two main reasons to explain this, the first is the radical difference between the mode of action of a spiral and that of a straight spur gear. With a spur gear the contact transition from one tooth to another is very abrupt, and the least irregularity in the relative position of the pair of teeth just coming into contact with respect to that of the pair either in contact or about to leave, is bound to result in a shock. With spiral gears several teeth may be in fairly good contact at various points and badly engaged at others; notwithstanding, the smoothness of the transition is such that no jar will be felt unless, at high speed, periodic vibrations set in. Even then the disturbance will not be as sharp as in the case of spur gears, nor are the deformations produced of the same kind.

The other, and paramount, reason is that the pressure per lineal inch of contact on the teeth of such pinions as we have analyzed is extremely light; the total length of the two parts—right- and left-hand—of the pinion being $2 \times 9\frac{1}{2} = 19$ inches, and transmitting 150 horsepower to each of the two gears, at a velocity of 7060 feet per minute on the pitch line, the resulting pressure per inch of contact is only 22.65 pounds. The pressure on the MacAlpine gear is 40 times greater, and still the designer almost apologizes for selecting a limiting pressure of 453 pounds per inch, while commonly observed pressures on spur gears amount to 1000 pounds per inch of tooth face at ordinary pitch-line speeds.

The Growth of the Patent Business, 1836-1910

By Irving D. Kimball

The accompanying chart shows the total patents issued by the United States Patent Office for each year, from 1836 to 1910, inclusive. It includes mechanical, design and reissue patents, and is made from information contained in one of the tables of the last report of the commissioner of patents.



Growth of the Patent Business

The table cannot indicate, as such a diagram as this can, the ups and downs of the patent business.

It is interesting and convenient to note the progress made when the mind does not have to wrestle with a mass of figures.

Thus it is seen that no appreciable advance is made until 1853. A healthy growth then continues until checked by the opening of the Civil war. Recovery begins immediately, however, and at the close of the war the patents issued begin to increase at a rapid rate.

The depressing times of the seventies are plainly evident, and then comes a quick recovery in the early eighties.

Following 1885 the road is rough and wobbly until the late nineties. Then the line proceeds upwardly by leaps and bounds until the panic of 1907, which, with other recent events, has brought about another period of "marking time."

This graphical record of the Patent Office might readily pass for the hospital temperature chart of the United States industrial world.

Referring to our Catalog "Z".

By Robert Grimshaw

I have received a one-page single-sheet circular of a very interesting machine, with a general view of the latter, and a statement of how good it is, and how children cry for it—but no description of its construction and operation, and no statement of what it will do in a given time, under stated conditions. I am referred to "page X-ty four of our catalog Z," which is a beautiful structure, costing at least a dollar to make; but after I have found it, although I have a picture of the principal feature of the machine, in detail, I get no description of this particular part, and no statement of what the machine will do per hour, on work of a given kind, when properly handled.

Now as on the second page of the circular sent, there was plenty of space to give all the details required by an intending purchaser, why should the manufacturer go to the expense of sending a dollar catalog to explain a two-cent circular that has room on the back for the necessary information? If I have not "catalog Z," why should I be put to the trouble of writing for it?—and it might perhaps come too late for my purposes, or those of my customer. And when I have "catalog Z," why should I not get therein the information which would be requisite in order to make a sale?

An outline of the scope of the International Exposition of Inventions to be held in St. Louis during the week of September 11 has reached us from F. W. Payne, secretary, St. Louis Coliseum Company. The enterprise is to be the first of its kind in this country and is inaugurated with the idea that such an exposition will give inventors an opportunity of bringing their new inventions directly before the general public to their mutual benefit. It is reported that an exposition of this nature is an annual affair in England.

Machine Tool Trade in Europe

By C. A. Tupper

Observations made during a recent trip through Europe indicating the extent and variety of the field for American tool builders. A continuous policy of development is advocated. Foreign trade has a steadying influence on machinery building in this country.

The sale of American machine tools in Europe has recently been entering upon a new phase of development. This is the result of a combination of circumstances, including (1) the changing requirements of users, (2) the extension of the field of operation, (3) the progress made by foreign competitors of American tool builders, and (4) the growth of the export trade from European countries to other parts of the world.

The first of these conditions has been due to the rapidly narrowing difference between European and American methods in the use of metal-working machinery of all kinds. Some of the best shops of Great Britain and the Continent are practically on a par, in this respect, with similar establishments of the United States and Canada. Others are approximately to the same standard, and in practically all European shops the equipment and system of operation show material improvement over those prevailing only a few years ago. The average efficiency of labor is not, in my judgment, equal to that of American establishments; nor do all of the new features brought out in our tools commend themselves to European users; but the tendencies observable abroad are very much the same as in this country. Tendencies are what count in export trade; for by the time they can be met they have become the actualities with which the salesman has to deal. What Europeans are thinking of now they will want in the near future.

In turret lathes European users have followed all of the developments made in this country, and the machines most salable on the Continent today are those known to Americans as the best of modern types. Manufacturing automatic lathes and screw machines are also selling to better advantage as their good points become familiar to shop managers on the other side. In these American manufacturers have a strong lead. Engine lathes, bench and speed lathes, meet with more even competition from foreign makes, and to be successfully placed they must possess undoubted superior merit. While I was in Germany, Dr.-Ing. Georg Schleisinger, of the Royal Technical High School, Charlottenberg, delivered a very illuminating address, comparing American and German practice in the designing of machine tools. From what he said on the subject of lathes it was apparent that American specialization keeps us still in advance; observations in the best-equipped plants tended to strengthen that belief.

Same Attention Needed for Foreign Trade As Is Given to Domestic

The opportunities open to American manufacturers are more numerous than ever before; but in maintaining their lead they must give to European trade the same careful attention that is bestowed upon domestic.

For millers from this country the demand is steadily increasing, as Europeans learn more and more of the innumerable uses to which they can be put. The leading manufacturers on this side have been well represented, and a great deal of demonstrating has been done by men in their employ who are experts in that line of work. This is particularly true of universal millers.

American-built variable-speed planers of the standard or widened patterns, which can show good records for accurate work at high speeds and are constructed along lines that indicate durability, will sell well in any part of Europe, even in the face of strong competition from English and German machines. Shapers also continue in fair demand; but accuracy, speed, rigidity and ease of adjustment are features which must be given every possible care in meeting the future requirements of European trade.

Upright drillers and bench drillers of American manufacture are closely pressed by a large number of European types. For sales of these our manufacturers must look chiefly to their inclusion in orders for complete lines of shop equipment. Radial drillers, however, from the simplest to the most ingenious multi-spindle patterns, have been much more highly developed in the United States than abroad, and their sale can be effectively pushed. The same is true of horizontal boring machines, drillers and millers, draw shapers, etc., which combine various functions. For special drillers there is a demand from certain industries.

For vertical boring and turning mills flexibility of operation, with such special features as index dials and feed-tripping mechanisms, quick-stopping and feed-changing devices, rapid traverse, etc., are among the requirements of the more advanced users. Mere massiveness, rigidity, etc., are not looked to as much as formerly. For very large, heavy work where speed and convenience of operation are only secondary foreign-built mills serve every purpose; but in the smaller sizes, which are the ones ordinarily sold, American manufacturers have as good opportunities as ever.

Horizontal boring machines, boring bars, etc., can be placed to advantage for portable service.

The variety and adaptability of American grinding machinery is such as to bewilder Europeans. Machines for special service can be readily disposed of abroad, but only on the basis of actual demonstration. Standard tools of this class also sell well, but meet with the same competition that exists in this country between the best known types. The same may be said of the wheels.

Gear-cutting tools manufactured in the United States have met with much favor abroad despite strong native competition. The tendency is more and more toward specialization for different classes of service, and the methods most successfully used here will eventually win out in all parts of the Continent.

American cold-metal saws have long been recognized abroad as the best adapted to severe continuous service, and they continue in good demand. Speed, accuracy, resistance to wear and convenience in operating are the characteristics still most considered, but any special features are given due regard by purchasers.

Among other tools of American manufacture in fair demand abroad are bolt and nut machines, broaching machines, centering machines, chucking machines, keyseaters, slotters, toolmakers' and sharpeners' outfits, and to a lesser extent pipe-threading and cutting machines, forging machinery for small work, bulldozers, formers, bending rolls, spacing tables and other boiler or assembling shop appliances. Pneumatic tools of all kinds maintain the lead that they have had for some years past, and a number of American manufacturers of cutting tools and machinists' supplies of every description have a trade so well established that it is almost invulnerable. In some European shops the men will sulk if given any but the American tools to which they are now accustomed. Instruments of precision from this side of the Atlantic are also in astonishing vogue, considering the fine work turned out by European workers.

In a number of lines, such as power and hydraulic presses, from the smallest used in machine-shop service to the heaviest forging machines; welding and brazing equipments; cranes; compressors; power-plant machinery; motors, controllers, etc.; pressure pumps; and various acces-

sories of metal-working, including nearly everything for the foundry, European manufacturers have very little to fear from American competition. Along some of these lines we have derived our most modern types from abroad and are producing them under licenses. In connection with foundries, however, it should be noted that American pattern-working machinery is considerably more ingenious and efficient, as a whole, than foreign types.

The Present Tendency Abroad

At present the tendency is more toward independent development. In the lecture above referred to, Professor Schleisinger stated as follows:

"We Germans have profited by the experience of Americans, especially in the line of automatic tools and machinery for special service; but we can truthfully say today that we have made good use of this teaching. Our machines now show their own characteristic features; we have gradually made ourselves independent and now follow our own path."

This is literally true, and henceforth, to an increasing extent, the tool builder of the United States, Germany, Great Britain, France, Switzerland and Belgium will sell his machines on their own merits without much regard to "imitations." The result will be a widening of experience and development, which in the end cannot fail to benefit all concerned.

The Extension of the Field

I said in the beginning of this article that the sale of American machine tools abroad had entered upon a new phase because (2) of the extension of the field. By this I mean two things: First, the enormous industrial expansion of the principal countries of Europe, and secondly the commercial awakening and modernization of the nations which have hitherto been unprogressive. Not only will there be a much greater demand in future for metal-working machinery with which to equip, remodel or extend plants in the lands of Northern Europe; but Italy offers rapidly growing opportunities; Spain and Portugal show considerable progress; the industrial importance of all parts of the Austro-Hungarian Empire is steadily mounting; the Balkan States, Turkey and Greece are coming into line, and in Russia alone are possibilities of future trade that will unquestionably show immense development within even the next few years. Then there are Asia Minor, Africa and the islands of the Mediterranean, where many repair shops have recently been established and some have grown into local industries of importance. Unless an American has traveled pretty extensively in the less frequented parts of Europe, he has no idea what the minor nations and dependencies are doing. In a small island port, for example, I came across a large machine shop, completely equipped with American tools, which was doing a brisk business; it was one of the last places in which one would look for such enterprise. Our consular reports tell of many opportunities in these out-of-the-way spots but they are largely ignored.

With the progress of the past few years, conditions abroad are tending toward a situation similar to that with which we were confronted in this countroy two to three years ago, when there were not enough tools manufactured to meet current demands. It is, therefore, going to tax the facilities of European tool builders to take care of even the proportion of the trade that they now have, without cutting any farther into the American manufacturers' share. Moreover, the progress which they are making along lines of independent development (3) will operate to the benefit of everyone interested in this trade, on whichever shore of the Atlantic he may be located. With the use of the most modern tools, uptodate shop methods and an increase in the individual efficiency of operatives in one establishment there comes the call from others for similar betterments and forms an ever winding circle of demand. In the line of machine-tool development, therefore, English, German and American designers, as well as those of other nationalities, can well afford to clasp hands rather than to view each other's efforts with jealousy; for the progress of each means in the final analysis the progress of all. The day is past when the advance of one people in any line of human endeavor is necessarily accompanied by a corresponding decline in the standing of another; and, for the good of all, no such situation should be permitted to creep into the machine-tool industry.

Export Trade of European Builders

A factor of growing importance (4) is the export trade of European tool builders, which has assumed proportions so extensive that it embraces nearly all the output of many concerns. So far as this trade includes sales made in neighboring countries, American manufacturers doing business abroad are brought into direct competition with European firms offering similar products; but a large percentage of the export trade of English and German tool builders, for example, is in distant lands overseas. To the extent that this is carried on, it lessens competition in Europe from the same sources and is particularly advantageous to Americans from the fact that it eliminates much of the depressing influence upon the market which arises from heavy offerings of the lower-grade machines. Nor does it cause any great loss of business to American manufacturers in the countries to which these exports are made from Europe, for the reason that our tool houses are not making any particular effort at present to secure that class of trade. In this respect conditions may, and probably will, change as time goes on; but I am dealing with the situation as it exists at this time.

Granting that the opportunities are favorable for pushing the sale of American machine tools abroad: Is the business worth going after? Let us look at this from varying view points.

Steadying Influence of Foreign Trade

"I am thoroughly convinced," said an eminent American recently, "that the one steadying influence on the manufacture of machinery in this country which can be depended upon, and which should be depended upon, is a foreign trade carefully nurtured. But, in order to have this successful and permanent, our people must be made to understand that they are not 'handing' foreigners something; that both sides are making a trade that is mutually satisfactory."

Anyone who has had an opportunity of looking at the situation from the European viewpoint will appreciate at once the significance of that statement. There has been a very unfortunate tendency on this side of the Atlantic to enter upon export trade without looking far enough ahead; to take it in the hop-skip-and-jump fashion of our school-boy days rather than step by step to a definite goal. What has been the result?

The first impulse of an American manufacturer, after deciding that Europe offers a field for the profitable sale of his machines, is to secure suitable representation there and start his campaign. That, however, is not the next step, and the failure to recognize this fact has, in the long run, done more to retard the general forward movement of our export business than any other one element.

Before taking any steps to cultivate foreign trade, before distributing literature, engaging agents or sending out men to demonstrate his machines, the American manufacturer should ask himself in all seriousness whether he is prepared to hold this trade when once it has been secured. Will he be ready to accept the sacrifices which it entails as well as its undoubted benefits?

Two to three years ago there was a brisk demand in the United States and Canada for machine tools and shop equipment of every description. Those who had the apparatus to offer soon fell behind on deliveries. The domestic demand exceeded the supply, high prices were readily obtainable and the tool builder realized, right at his door, a profit too heavy to be refused. Under the circumstances it seemed foolish to send machines thousands of miles away where they would not only net less but would keep the money already invested in them tied up for a far longer period. Export trade was in numerous cases thrown to the wind; the needs of foreign customers fell on deaf ears; European salesmen

clamored in vain for their share of deliveries. Business which it had taken years to build up abroad became diverted into other channels. The assumption seemed to be that, when this was again needed, it could be recovered. But was it? In probably the majority of instances American tool builders who temporarily abandoned their position in European countries found that they had to start again almost from the beginning, with only the advantage of previous experience and the prestige of existing installations.

It, therefore, behooves the manufacturer on this side to decide carefully at the outset whether or not he will reserve a portion of his output for export trade, no matter what the inducements may be for disposing of it all in the domestic market under such conditions as those above noted. If he cannot answer this question in the affirmative, it would be better not to start a new or more extended selling campaign in Europe. The initial expense of any proper effort will be certain to overbalance the immediate gain.

Continuous Policy Necessary

The manufacturer who is already disposing of a fair proportion of his output abroad and feels that he wants to pursue, for the future, a definite, continuous policy of expansion, will do well, first of all, to look to his selling arrangements. Let him see that he has competent branch offices, managers and salesmen or is represented by live, conscientious agents. There are vast differences in this respect. Then let him make similar provision for carrying his goods into new territory, as above enumerated, as fast as it can be developed.

For the tool-builder entering upon an entirely new campaign abroad, after satisfying himself that a demand for his machines can be created, the first step is to secure representatives who are able to furnish the right sort of American references.

Then, in either case, the European representatives should be given adequate backing and support. They must be, themselves, thoroughly posted on the construction, special features and operating advantages of the machines which they have to sell; they should have the aid of good descriptive literature printed in German and French for use on the Continent and couched in terms comprehensible to European users; their promises of delivery, directions for shipment, terms of payment, etc., ought in all cases to be scrupulously complied with.

For his own part, the manufacturer desirous of building up an export trade should realize that respect for the established methods and traditions of European users of machinery is an important factor in its sale. There are decided advantages in voluntarily ascertaining and catering to these, instead of being driven into doing so.

General Factors

An intelligent study of the requirements of European markets should both precede and accompany all sales effort; minor changes in standard machines to meet customers' preferences frequently mean a great deal, not only in placing them but also in their successful operations; the use of metric terms in correspondence as well as metric measurements on the tools is practically indispensable.

The necessity of proper packing should not be overlooked, and accessibility to customs examinations, including the use of screws in boxes instead of nails, is an important point to consider. As the various parts are packed they ought in every case to be double-checked. If practicable, a stock of repair parts and spares should be kept in London or some city of the Continent, to be available for immediate requisition.

Plain directions for installation and operation ought to be printed on tough paper—in both French and German for the Continent—and at least one copy mailed to the customer and another boxed with the machine.

The value of expert demonstration in the sale of machinery is so well recognized that no elaborate comment on that point needs to be made here, further than to say that it yields rich returns in any export campaign. The best results are to be obtained by sending skilful operatives on trips with the branch office or agency salesmen to interest prospective customers or clinch sales by showing in the presence of the latter just what the machines can be made to do. If the salesmen possess any mechanical ability, as they should for this character of work, such exhibitions will teach them to become good demonstrators themselves.

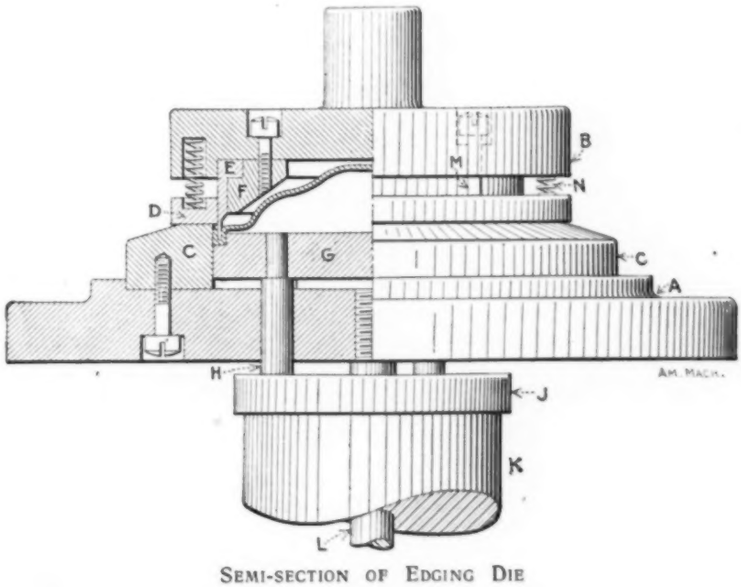
Another and often decisive advantage is to have one of the executive officials of a machine-tool building concern, who is a *practical* man in this line, make a tour of the industrial districts of Europe, note local conditions, observe the kind of work that is being done, compare his tools with those of European make for similar service, see how nearly the efficiency of labor under varying circumstances approximates to American standards, get acquainted with European business customs, preferences, methods of collection, etc. Incidentally he will meet prominent men in the metal-working industries whom it is difficult for the ordinary salesman to see, make many desirable acquaintances and get in touch with the situation generally in a manner that correspondence would never bring about. The field is there, and, while its opportunities have already been realized upon very largely by some of our leading manufacturers, the future holds promise of more.

An Edging Die

By Lawrence Abel

When making automobile lamps of the built-up type, that is to say, where the lamp body and back and taper are separate pieces fastened together by seaming, it becomes necessary to turn an edge on both parts, then to interlock them, and, finally, to place them thus in a suitable die, or in a spinning chuck, to roll the joint out flat. For producing the edge on the lamp back, the following construction in a die will be found to be efficient, cheap, and easily repaired.

The die is shown in semi-section in the accompanying figure. *A* and *B* are the die shoe and punch holder respectively. They are both made of cast iron, and the die shoe is recessed to take the edging die *C*, of hardened tool steel, and fastened to the shoe with six machine screws. A steel stripper-plate *G*, hardened and ground, is actuated by three rods *H* over a rubber bumper *K* and bumper plate



Semi-section of Edging Die

J, and thus ejects the back after edging. The bumper is secured to the die shoe *A* by a steel stud *L* in the usual manner.

Attached to the punch-holder is the edging-punch *E*, of hardened tool-steel, and held in place by the guard ring *F*, which in turn is screwed to the punch holder *B*.

A soft-steel stripper ring *D* surrounds the punch and is limited in its travel by six shouldered studs *M*. The stripper ring is actuated by six helical springs *N*. This strips the piece from the edging-punch and leaves it lying on the die after the operation.

The back is flanged before edging, the flange being produced in the drawing operation and the succeeding trimming operation. The circular boss on the ejector plate *G* locates the back in the die.

The tool is clean and fast and its principle is adaptable to many similar purposes.

Some Operations on Lathe Aprons

Western Correspondence

Jigs used under the radial drill for boring bearing holes in lathe aprons, facing off bosses, counterboring openings, and reaming and tapping.

The jigs are fitted up with permanent bushes in which cast-iron sleeves on the various cutter bars and tools are slipped when the tools are brought into action. All wear that takes place is thus confined to the interior of the inner bushings, as these cannot revolve in the receiving bushings in the jig.

The accompanying illustrations show some of the tools used by the R. K. Le Blond Machine Tool Company, of Cincinnati, Ohio, in machining aprons for "heavy duty" lathes.

The aprons used on these machines are of a box type, cast in one piece so as to give stud support on each end, therefore making the machining a little more complicated than on the average lathe apron, with the consequent necessity of a greater number of jigs and tools.

These aprons are first placed in a fixture and milled along the top to form the joint and tongue by which they are later located and secured under the front edge of the lathe carriage. The holes for the screws for attaching the apron to the saddle are then drilled and tapped and the apron is ready to be placed in the jig, Fig. 1, where all of the important bearing holes are drilled, bored and reamed and where such openings as have to be counterbored or tapped are also finished.

The Boring Jig

The general form of the jig and the types of tools used under the radial drill are shown clearly in Figs. 1, 2 and 3, and a layout of the apron itself showing the double wall construction, with the position and sizes of the holes to be bored, is reproduced in Fig. 4. A drawing of the jig with details of its bushings is represented by Fig. 5, and this engraving shows the method of locating the apron in the jig by means of its tongue. It is secured by tap bolts passing through the wall of the jig and into the tapped holes in the top of the apron and the latter is thus held in the same way and against the same surface as it will be when permanently attached to the carriage. The heads of the bolts will be seen in Fig. 3. The positions of the jack screws for supporting the lower end of the apron in the jig after it has been bolted in place are indicated in the drawing, Fig.5.

This jig is used in conjunction with an outfit of 41 tools and the complete equipment is represented on the stand in Fig. 2. In some cases as many as six or eight tools are required for finishing one hole and a set of tools for such a hole will be noticed on the bed of the radial in Fig. 1.

The Nature of the Boring Tools

The tools for various holes consist of high-speed twist drills, double-end boring cutters in bars of the required lengths, facing cutters, flat counterbores, reamers and taps. With the exception of the drills, which are guided in steel bushings, and the longest of the cutter bars, the tools are operated in long cast-iron bushes which remain on the tool shanks and are entered in the regular jig bushings with the cutting tools and removed when the tools are withdrawn.

These long cast-iron bushings provide ample bearing surfaces for the cutter

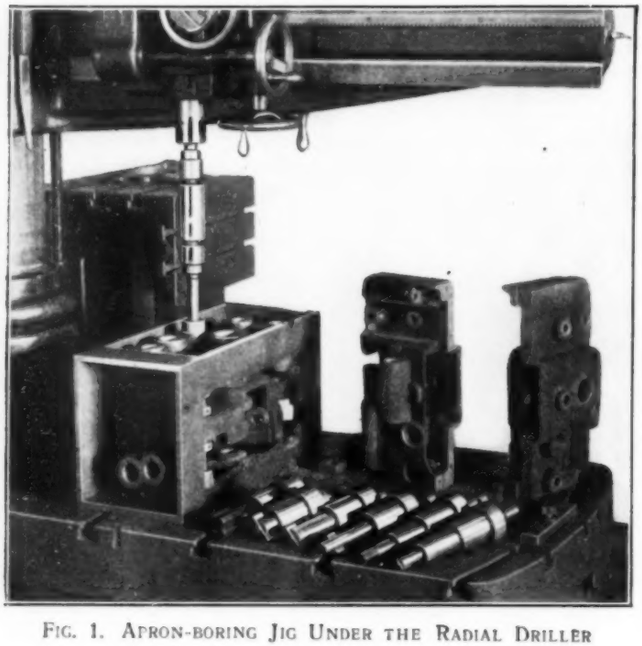


Fig. 1. Apron-boring Jig Under the Radial Driller

Fig. 2. A Set of Apron Tools

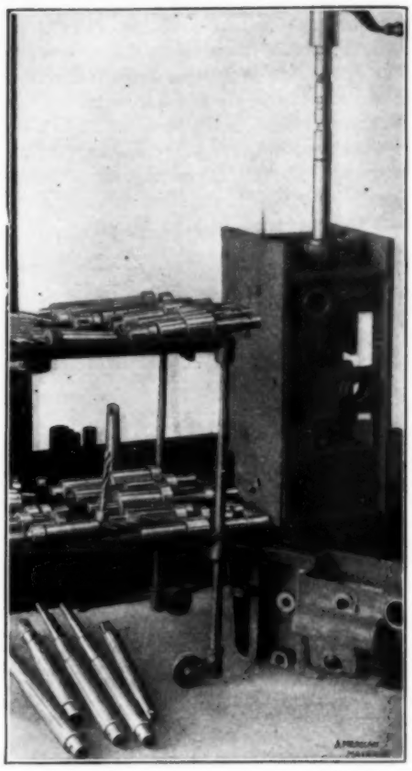


FIG. 3. ANOTHER APRON-BORING OPERATION

bars, reamer shanks, etc., and as they are prevented from rotating in the permanent bushings in the jig, there is no wear imposed upon the latter bushings and the accuracy of the jig is maintained indefinitely. The length of the bearing bushings or sleeves is sufficient to reduce to a minimum the possibility of wear in these members themselves. However, as they are inexpensive and readily replaced they can be easily discarded upon the first indication of inaccuracy due to wear and it is thus always possible to hold the jig and its tools to a very high degree of accuracy.

In all cases the tools are operated by a floating connection with the spindle, and the long sleeves are relied upon to guide the tools correctly. In some cases, say where a long boring bar is applied,

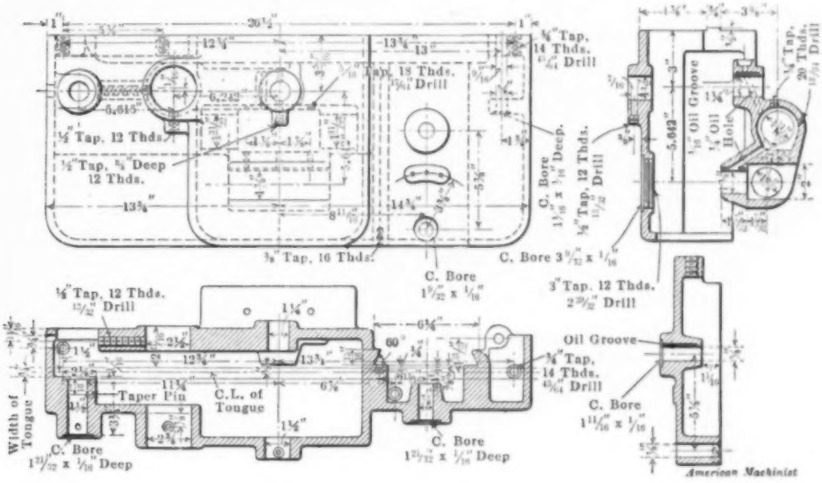


FIG. 4. APRON FOR 25-INCH HEAVY-DUTY LATHE

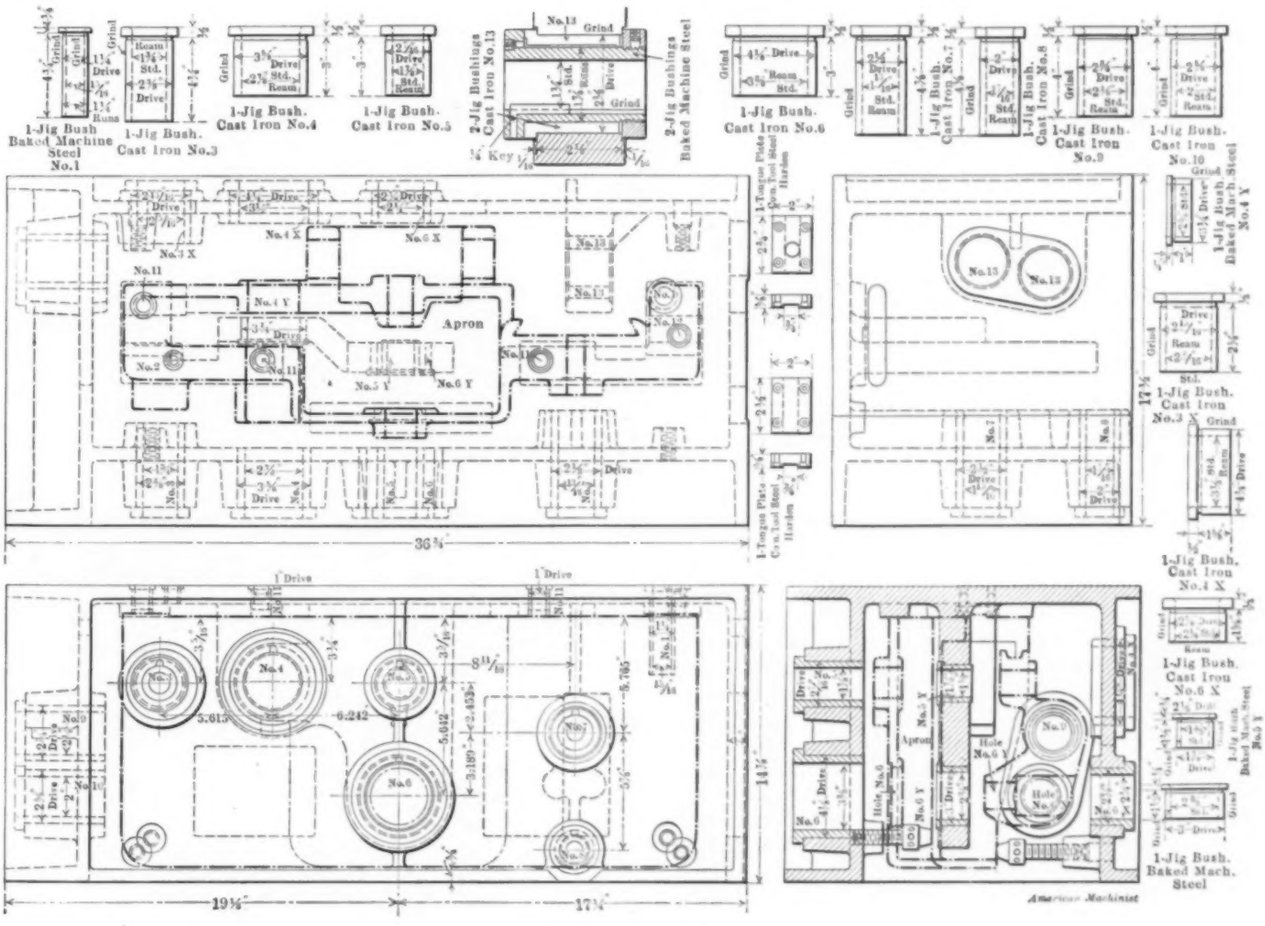


FIG. 5. APRON JIG

the jig is, of course, fitted with two bushes to provide bearings at opposite sides of the work. An operation of this nature with a long bar and with the jig standing on end is illustrated in Fig. 3. A good many of the tools, particularly those of light character, are provided with shanks adapted for use with quick-change sockets, and this feature naturally facilitates the process of changing from one tool to the next.

Details of a Set of Tools

In Fig. 6 a set of tools is shown in detail. These are for machining the holes Nos. 6, 6*x* and 6*y* in Fig. 5. Upon referring to that drawing and to Fig. 4 it will be seen that hole No. 6 is a 3-inch tapped opening in the outer wall of the apron and directly behind and in line with it is a hole which is 1⅜ inches diameter at the inner end and enlarged to 2 inches at its outer portion. Like all the other bearings bored out in the apron for studs, shafts, etc., these holes have to be straight, accurately alined, and true to size.

Boring cutter *A*, Fig. 6, is operated through bushing No. 6, Fig. 5, to open out hole No. 6 to the right size for tapping. Facing cutter *B*, Fig. 6 is operated in the same bushing to counterbore the mouth of the hole. Tap *C*, Fig. 6 threads the hole 12 per inch. In each case the cutting tool has its own sleeve or bush of cast iron which fits into steel bush No. 6 in the jig, and which is prevented from rotating in that bush by a pin under the head engaging in a pocket formed in the steel receiving bush.

Reaching the Other Holes

In order to reach the holes 6*y* and 6*x*, Fig. 5, longer cutter bars and longer bearing bushings are provided as at *D*, *E*, *F*, *G*, Fig. 6. These tools have sleeves that fit the 3⅜-inch steel bush No. 6 and at the same time fit at their smaller ends in the intermediate jig bush No. 6*y*. This gives a double bearing for the supporting bush and its length insures the boring tools and reamer securing proper support for operating in hole No. 6*y*.

The facing cutter bar *D* machines the end of the boss 6*y* and tools *E* and *F* are brought into service for boring the opening to the desired size for reaming. Then reamer *G* with its long bushing is run through the hole to size it correctly.

These operations then leave the enlarging of hole 6*x* to be accomplished from the other side of the jig, and boring bar *H*, with a 2-inch flat counterbore, is run into the 1⅜-inch hole 6*y*, the cast-iron bushing on the bar being slid into jig bush 6*x* and the outer end of the cutter

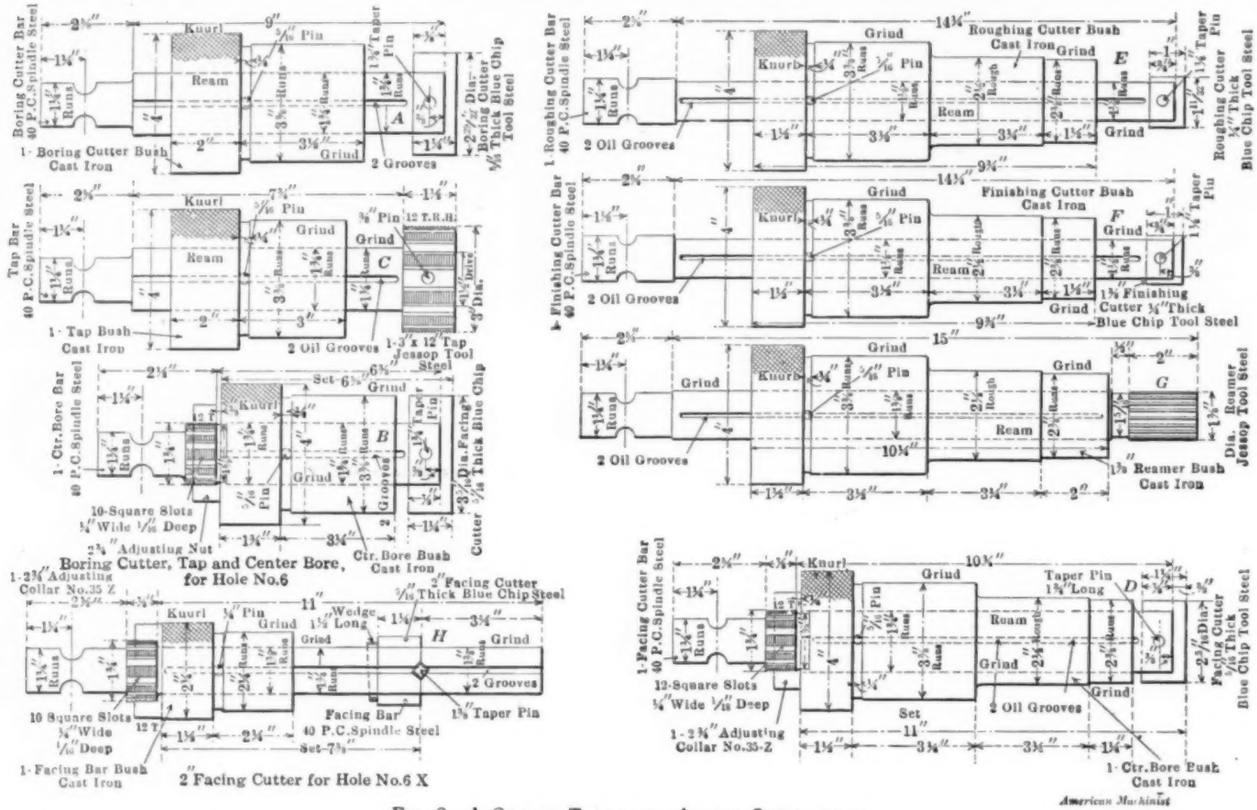


Fig. 6. A Set of Tools for Apron Operations

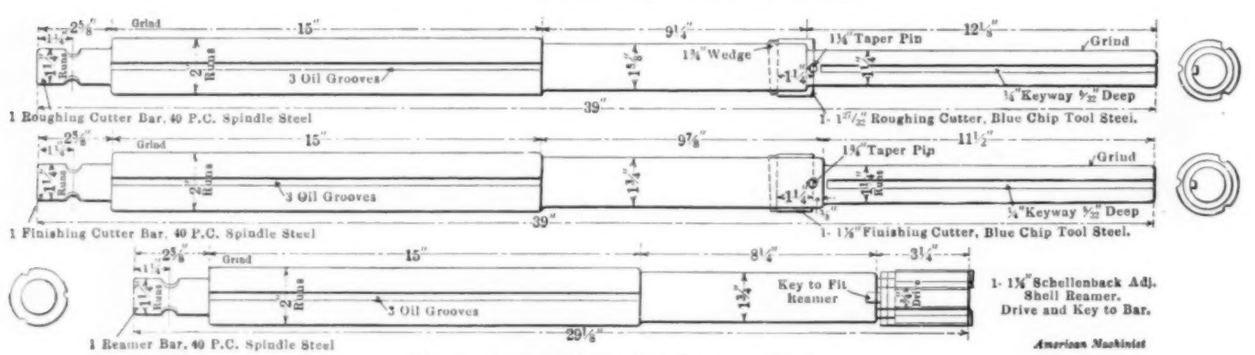

1 Roughing Cutter Bar, 40 P.C. Spindle Steel
1 Finishing Cutter Bar, 40 P.C. Spindle Steel
1 Reamer Bar, 40 P.C. Spindle Steel
American Machinist

Fig. 7. Long Boring and Reaming Bars

bar taking a bearing in the hole 6*y* so that the tool is well supported at both ends during the counterboring process. This tool, like facing bars *B* and *D*, is equipped with adjustable stop collars that limit the depth to which the cutters shall be run and which assure accuracy in the facing and counterboring operations.

Longer Boring Bars

All the cutter bars are provided with oil grooves as shown in Fig. 6 to insure proper distribution of oil along the bearing surfaces during operations. The longer bars, as represented in Fig. 7, have three oil grooves along that portion of the body which runs in the guide bush. The bars shown are for machining the longitudinal bearing in the apron for the hubs of the bevel pinions through which passes the feed rod.

The hole is finished 1⅞ inches diameter, and the boring bars, Fig. 7, are guided at one end in bushing No. 10, Fig. 5, and at the other end in bushing No. 13. By referring to the enlarged detail of bush No. 13 at the top of the drawing it will be noted that there is an inner bushing with 1¼-inch bore and with a feather inserted therein so that the splined boring bars (Fig. 7) when inserted will be engaged by the feather and will cause the inner bush to revolve with the bar in the outer bushing No. 13.

The revolving bushing has a large flange on its upper end and dirt and chips are excluded from the working surfaces. This type of bearing gives the boring bar the same support in the jig as it would have if operated in a boring machine with regular outboard support.

The oil holes in the apron are drilled in another jig after the completion of the boring operations.

Another Side of Efficiency Engineering

By Dexter S. Kimball *

An examination of the principles of industrial efficiency as lately laid down, leading to the conclusions that they are not new by any means and that they offer no hope for a real solution of our industrial problems.

*Professor of machine design and construction, Sibley College, Cornell University.

In these days when hurry and speed are the keynote of industry it would seem to be almost sacrilegious, or at least a mark of ignorance, to raise one's voice even in doubt, to say nothing of protest, against any ways or means for increasing production. Yet I cannot but think that only certain aspects of some of the new methods of increasing production are being presented and that those aspects, which are so alluring, entirely overshadow certain others and hence do not give a true perspective of what the net results will be. Now I may be entirely mistaken in my point of view. If so I shall be glad to be corrected and will no doubt find many who will be glad to correct me.

In the outset I wish to state that I believe firmly in modern methods of production and appreciate fully what increased productive power by means of machinery and improved methods have done for our civilization. I believe we should welcome and encourage any and all new discoveries in machinery or methods which will enable us to still further increase our capacity in this direction and gladly accord the honors due to those who have been and now are leaders in this work. No sane man questions the *net* results to humanity of improved modern methods as far as they have effected physical and mental well-being. No one who knows much about manufacturing doubts that many of the methods now being advocated in many quarters under the name of "Efficiency Engineering" will still further multiply the fruits of human effort. The questions which I wish to raise concern the *expediency* of certain methods of applying them and the social and economical effects which are claimed for their application.

The mental and physical welfare of the individual members of any form of organized society are dependent largely upon three factors, namely:

(1) The natural resources at the command of the community.

(2) The tools and methods of production which are available to develop these resources.

(3) The knowledge and organization whereby the fruits of labor may be fairly and equally distributed.

In the early and simple forms of organized society where resources were ample but tools of production primitive, the third factor came very nearly being realized in full; but as society became more and more complex it became increasingly difficult for the producer to enforce his demands and secure the full return for the service which he had rendered to society. The introduction of machine processes and the tremendous extension of division of labor, intensifying as they have the complexity of our social organization, have still further intensified this difficulty. The effect is greatest where the skill or intelligence of the worker is least. Experience shows that the rate of pay for industrial workers has not increased in proportion to the increase in productive capacity; he would indeed be a bold man who would contend that in our organization today with its immense burden of high financiers, grafters, drones and incompetents, the producing classes, including employer and employee, are receiving full return for the services which they render.

Many civilizations have possessed immense natural resources, and the modern nations possess tools of production such as the world has never seen; but only in the simplest forms of organization has equitable distribution of the products of labor been achieved; all experience goes to show that *increased productive capacity* does not *necessarily* mean increased revenue to the producer; but on the contrary may, if he is not alive to his own interest, mean an actual decrease. We read of few nations who have starved to death for lack of tools or methods of production, but the highway of history is paved with the bones of civilizations which came to grief on the rocks of unfair distribution. Many of the existing modern nations still carry dreadful scars received in bloody revolutions which had their genesis in this, the greatest of problems of organized society, while many more tremble on the brink of similar disasters.

Principles of the New Industrial Efficiency

With these things in mind let us examine the principles of the new industrial efficiency as laid down by its leading exponents. Reduced to a simple statement they consist of:

(1) A complete staff or planning organization to supplement the ordinary line organization with complete division of labor so that all men have but a few duties to perform.

(2) The establishing of standards for both tools and performance of work based on known facts instead of rule of thumb.

(3) The careful selection and training of all workers.

(4) The setting of tasks and fixing of rewards for the accomplishment of work according to the methods specified by the staff organization.

(5) Close coöperation between workers and employers.

There are many other features advocated but as most or all of them are in common use in the majority of modern manufacturing plants they may be omitted from this discussion.

Staff organization and the study of time units are not new by any means. The first has been growing steadily in all kinds

of organizations for many years. It is a logical and direct outgrowth of the extension of the principle of division of labor due to the necessities arising in handling large bodies of men and in applying science to productive methods. The growth of the engineering departments attached to large manufacturing plants is an example of fine staff organization. Neither is time study in its essence a new idea. Builders of machine tools, for instance, have for many years been putting forth efforts in this direction and some of the new geared-head lathes with quick change mechanisms which can be operated without the operator leaving his working position or even raising his eyes from his work are marvelous examples of time and motion study. The new "efficiency engineers," however, are entitled to great credit in showing that these principles can be extended in much greater detail with a corresponding increase in production, and in showing that they can be applied in many fields hitherto entirely neglected. Most of all we are indebted to them for a more logical or scientific method of approaching the problem of finding out how long it should take to do a given piece of work and what constitutes a fair day's work.

In order that these principles may be extended and applied the workmen must be interested, hence a task is set to be performed according to the directions of the planning department and the workman receives a bonus if he successfully performs the task.

No one can reasonably doubt that the extension of these methods in greater detail will, in general, give increased production, because they have been applied already on a very large scale with great success. And there can be little doubt but what these methods will come into common use and their field extended more and more as they are more fully understood. Labor-saving machinery and processes always, eventually, come into common use no matter what the opposition to their adoption may be. In the long run it would seem that humanity as a whole benefits from their adoption. It may be noted in passing that the effect of new labor-saving processes and methods is very similar to that of labor-saving machines, namely, to put actual production in the hands of inferior classes of men under the direction of a few more highly skilled or more intelligent leaders. This tends to further extend the principle of division of labor and to disintegrate what are commonly known as trades into fragmentary portions where each worker performs only a small part of what was formerly the work of one man.

Now in the methods under discussion where refined measurements are made of the physical and mental abilities of men it puts into the hands of the employer a more powerful *selective* agency than he has hitherto possessed. If this selective power be used solely for the purpose of *sorting* men so as to eliminate the indolent and those who are clearly unfit for the work in hand there can be no objection raised to them from the humane standpoint. If, however, they are used to *eliminate* all but the very best workers their effect will be disastrous both from the humane and from the economic standpoint until an entire readjustment of the field has taken place. There are at present more men than positions. Any scheme which tends to still further concentrate labor in the hands of a few can hardly be desirable; and in the hands of grasping employers such a result is possible. What is wanted is a scheme whereby *every* man can be worked up to his full efficiency whether his output be as great as his neighbor or not. Economically there can be nothing gained by concentrating labor in the hands of a few picked men if they must support indirectly a large number of idle or poorly paid men. Efficiency is, after all, only a relative term and it is far better that all men be producing up to their capacity than that all the production be by the relatively more efficient. We are as much in need of men who can organize industries and lead the army of producers as we are in need of more refined methods of production.

Some Claims of the Advocates of the New Methods

These new methods then, in so far as we have discussed them, are means of increasing man's productive power and fall, therefore, under the second item of the classification made in the first part of this paper. To what extent will they effect the third item, namely, equitable distribution of the products of labor? The advocates of these new methods make such claims as the following:

"The great increase in wages which accompanies this type of management will largely eliminate the wage question as a source of dispute."

"The one cure, the only one for the condition that confronts us, is to increase the efficiency of the producer."

"The low cost of production which accompanies a doubling of the output will enable the companies who adopt this management, particularly those who adopt it first, to compete far better than they were able before, and this will so enlarge their markets that their men will have almost constant work even in dull times, and that they will earn large profits at all times.

"This means increase in prosperity and diminution in poverty not only for their men, but for the whole community around them," and many other statements of the same tenor.

That is, to say, increased productive power necessarily means increased profits and their resulting comforts to the actual producer; for a diligent search through the literature of efficiency engineering fails to disclose any new principle regarding the distribution of the fruits of labor. True, great stress is laid on the "square deal" and the coöperation of the employer and employee; but these are not peculiar to any system of management.

It is also, of course, true that decreased cost of production always gives the employer an opportunity to pay better wages until his competitors obtain the same methods, when the natural law of competition again comes into effect, and the employer is again confronted with the choice of smaller profits, lower wages or still more refined methods and improved tools.

Parallel between Labor-saving Machinery and Labor-saving Management

The greatest gain in productive ability which the world has ever witnessed came with the introduction of labor-saving machinery. All the possibilities for the physical and mental betterment of humanity offered by the most tremendous gain in productive power mankind has ever witnessed were opened up at that time. The immediate effect of these new methods was to reduce the workers concerned to a state of pauperism and wretchedness which was relieved only by legislation and other reactive measures and not by anything inherent in the new methods. These methods have been improved and added to steadily for over a hundred years and what is the net result? Today the skilled mechanic who can save a competence is a rarity. Instead of the individual independence which every man should be able to acquire, we are talking of governmental and other forms of pensions; in spite of our much vaunted increased educational facilities only 25 per cent. of the entire population of this, the most favored of countries, get the minimum amount of education which is considered necessary to make them intelligent citizens. True, the workman of all kinds has benefited very greatly by the improved methods, and it is also true that he is better clothed, fed, housed, and particularly better educated than formerly; but the fact remains that his progress has not been proportionate to his increased productive capacity.

I am willing to concede, therefore, that these so called new methods will increase production; that in all probability they will, in time, be generally used and that the general effect should benefit humanity; but I see no reason for thinking that they inherently possess any power to change the problem of distribution. It may be that these methods will even make it necessary for the worker to redouble his efforts. Even the most ardent advocates of the new methods are compelled to acknowledge at times the truth

of these statements, as for instance, the following:

"Inasmuch as mechanics as a class get little benefit from the development of a better method or a labor-saving process, they are, as a rule, little interested in such improvements."

And again: "If the fruits of scientific management are directed into the proper channels the workingman will get, not only a fair share but a very large share of the additional profit arising from improved industry. In order that the workingman may get this large share of the benefits through higher wages, shorter hours, and better working conditions, the labor unions must participate in fixing those wages, hours and conditions, and in determining the application to the various businesses of the principles of scientific management." And this is the crux of the whole matter. If the fruits of production under methods as they now exist could be more fairly distributed and the wastes due to foolish and oppressive financiering eliminated so that the producing classes, employer and employee alike, would receive what is justly theirs, much of the problem would be solved; if Mr. Taylor or Mr. Gantt, or Mr. Brandeis can only tell us how this can be done, they will do more for humanity, as it exists in organized society, than any one, economist or engineer, who has ever walked this planet, and infinitely more than can be accomplished by the most refined methods of production which they can develop. The great problem which confronts us is not and has not for many years been that of production, but distribution. We can now produce more manufactured goods than we can use, and far more than is needed to make us all comfortable. All the new productive processes possible will throw little light on the problem of why we find in many places, at one time, storehouses filled with raw material, idle factories equipped with the finest tools the world has ever seen and people walking the street without food or clothing, yet willing to work.

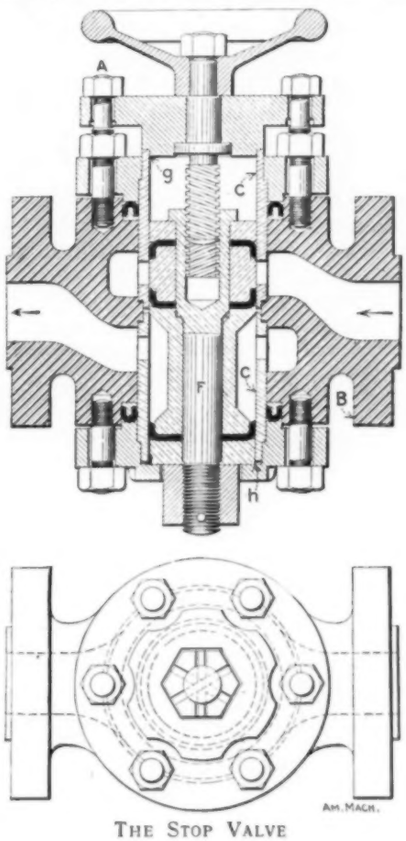
The problem is too complex to be solved by the simple expedient of increased production. There still remain the questions of competition, unfair taxation, immigration and a dozen other factors that are not as yet within the control of the employer, be he ever so fair minded, or of the employee, be he ever so strongly organized. I am not so sure but what a small readjustment of some of these would do as much for the workers, both employer and employee, as a large increase of productive power. What we need most is scientific distribution. Fortunate, indeed, will we be if some of the reactive influences now at work on our social and industrial organization will point the way to this much needed readjustment.

A High Pressure Cup Packed Stop Valve

By Jas. Clark

The valve shown in the accompanying figures was designed to replace some gate valves which had given more or less trouble, and which were practically useless at the end of four years' service. The valves are located in the feed lines to the hydraulic presses (pressure 1500 pounds per square inch).

A valve that was required, as soon as it commenced to leak, could be easily repaired and made tight. All that is necessary in the present design is to remove



The Stop Valve

the six ⅝-inch nuts *A*; then, the stem with the cups complete can be pulled out, the worn cups replaced, and the stem put back into place; an operation that may be done in less than one hour.

The body *B* is a steel casting. The inlet and outlet are 2 inches in diameter. The bushings *C* are 3½ inches inside diameter and were made from drawn brass tube ⅜ inch thick. They are provided with 16 inlet ports *d* and 16 outlet ports *e*, each ⅜x¾ inch. The cup seats, distance pieces, and screw, are brass, while the stem *F* is soft steel, brass not having the requisite strength. The clamping parts and handwheel are cast iron.

The joints in the center are made tight by the use of gaskets, but it was not considered safe to use gaskets for the end joints; hence, the U-cups were used instead. The bushings were made a slip-fit in the body. It is also necessary to have vent holes at the points *g* and *h*, so that in case a cup should leak, the balance would not then be destroyed.

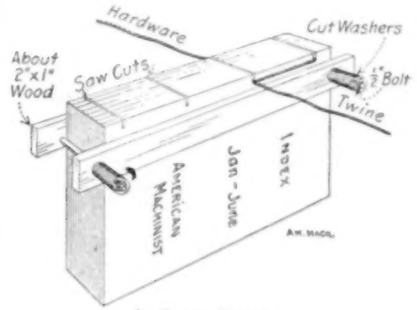
A question is raised as to whether a valve of this type will cause a greater loss of power than a gate valve. For use in a line through which pumps are forcing water direct, I do not think it would be suitable; but for hydraulic service, where the pumps are working against the accumulator pressure all the time and the flow of water through the lines is controlled by the operating valves, I do not think there is any loss of power due to the use of a valve of this type. These valves certainly do not affect the static pressure, and that is what does the work in a hydraulic press.

A number of these valves are in service and they are absolutely tight.

A Good Binder

By F. D. Buffum

A problem confronting most of the readers of the American Machinist is that of preserving information, of value to them, in a handy form.



A Good Binder

For two years I tried loose-leaf note books, cutting and pasting the clippings into them. Then for two years I used a pamphlet case system of filing whole pages. With both I used a card index in which I also filed the small clippings. But I finally came to the conclusion that I couldn't better the index that the publishers furnished free with each volume, and that my numerous note books, pamphlet cases, etc., were about as bulky as bound volumes are not so valuable.

Finally I secured the clamps, bolts, etc., as shown in the illustration and for the last five years I have been binding my own magazines. I can bind a volume of twelve numbers in half an hour, including putting on and trimming a cover of tough drawing paper. The method of procedure is as follows: First arrange the magazines in sequence. Stack evenly and clamp as shown. Finally make saw cuts at intervals in the back, smooth it off, daub with mucilage and weave twine in and out of the notches, knotting it in the last one, and finish with a tough paper cover.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

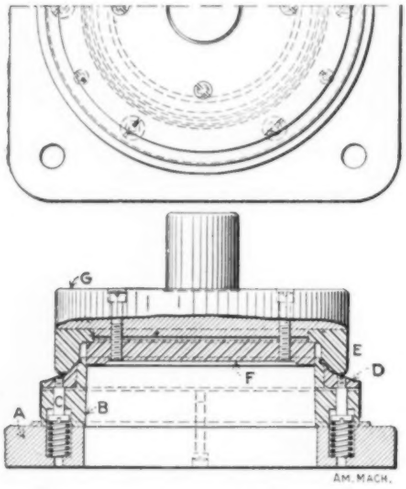
A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Center Piercing and Edging Die for Lamp Flare Ring

While going through the plant of a local automobile-lamp factory some time ago, I was shown several very interesting press tools used in the production of lamps. Among these, the die here shown is of interest on account of its simple and strong design; the work turned out by it was excellent.

The accompanying figure shows the die in its extreme down position; the piece being operated on is shown in place.

A cast-iron shoe *A* is bored out to receive the hardened and ground tool-steel die ring *B*, which is attached to the shoe by six fillister-head screws, as shown in the plan view; the upper part of this die ring serves also as a drawing or edging punch after the piercing operation is completed by the entrance of the piercing punch *F*, which is of hardened tool steel, and is attached to the punch holder *G* by four screws, as shown.



CENTER-PIERCING AND EDGING DIE

No dowels are needed in *E*, *F*, or *B*, as all of them are located by being let into recesses, and as they are round, this is the only location needed. A soft-steel stripper ring *D* surrounds the die and is actuated by helical springs in the counterbored holes in the base, its upward travel being limited by shouldered screws *C*.

The drawing or edging die *E* is a hardened tool-steel ring attached to the punch holder *G* through the clamping action of *F*, and its lower surface is shaped to fit the lamp flare in order to hold it from wrinkling while being edged. It will be noticed that the piercing punch enters the die *B* before the edging die *E* starts to operate.

These tools were being used on standard Bliss presses and were giving excellent results.

Detroit, Mich. ARON LAWRENCE.

A Portable Driller for Heavy Work

In our factory we have a great many repair jobs on heavy machinery that is to large to take to the driller, so we designed this machine to suit our own needs.

It consists of a heavy "old man" *I*, carrying the main frame of the machine, which can be adjusted up or down or swung in any direction.

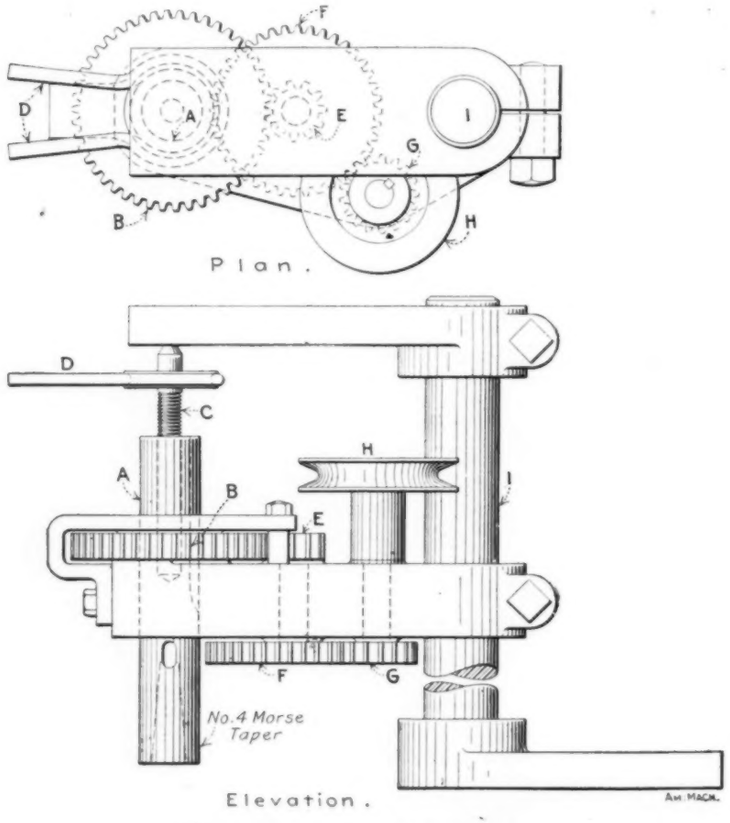
Power is applied to sheave pulley *H* and transmitted to spindle *A* through a train of gearing *G F E B*, which reduces the speed of 1100 revolutions per minute at the pulley to about 65 revolutions per minute at the spindle.

As we have electric power available all over our factory, we use a 1-horsepower motor to drive the machine. The feed screw *C* turns with the spindle except when momentarily held by feed clamp *D*.

In practice we have sheet-steel guards completely covering the gears, but these are not shown on the drawing.

We have had this machine in use for several months and have done a good deal of heavy drilling that we should have been obliged to do with a ratchet drill if we had not possessed this machine.

Philadelphia, Penn. W. ALTON.



PORTABLE DRILL FOR HEAVY WORK

Simple Tool Record and Storage System

The tool-record system described here has several good points, among which are extreme simplicity and the fact that a receipt is obtained in person from the party taking the tool for use. In the large factory where this system is in use, all special tools and fixtures are kept in fireproof vaults conveniently located near the various departments, and are given out to the machine operators as occasion requires. After the completion of the work on which they are used, the tools are returned to the vaults.

Each of the vaults is under charge of a keeper, whose duty it is to see that only authorized persons obtain possession of the different tools, and that a strict record is kept of all transactions.

Part No. 692

Name of Part Spindle collar, 6"

Operation	Name of Tool	Location
Scr Mach	Form & Cut-off	C-2-6
" "	Gauge	C-2-6
Drill & C'bore	Jig	C-1-6

American Machinist

FIG. 1. RECEIPT FORM

The vaults are divided into convenient compartments and shelves, and the vaultkeeper has a card index showing just where all the contents are located. The cards are filed numerically, according to the part numbers of the pieces on which the tools are used. Indexing the cards by part numbers has very obvious advantages over an alphabetical index, in that it avoids cross indexing, and any particular card can be located in a few seconds. Fig. 1 shows a specimen index card.

Part Number 692	TOOL STORAGE CARD	Tool Record No. 14361
Name of Tool	jig	
Name of Operation	Drill & C'bore	
Loose Parts with Tool	Slip Bushing	
Vault Location C-1-6	Delivered to Department D	
Delivered to John Doe #791 Signature		Date Delivered 4-3-10
Returned to C Smith Signature		Date Returned 4-7-10

Form 901 American Machinist

FIG. 2. TOOL-STORAGE CARD

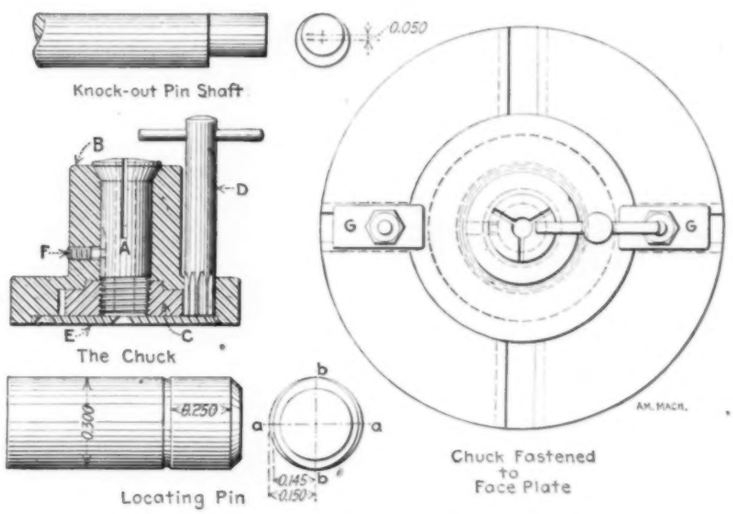
When a workman desires to draw out a tool, for instance, the vaultkeeper makes out a form as shown in Fig. 2; the workman receiving the tool is required to sign this form in triplicate, one original and two carbon copies being made at one writing. One copy is filed numerically under the part number of the piece on which the tool is used, one copy under the workman's clock number, and the third copy is delivered to the workman, and retained by him. Thus, the vaultkeeper knows just where the tools for a certain part are, just what tools a certain workman has in his possession, and has his receipt for them.

When the tool is returned to the vaultkeeper, he is required to sign the copy of the record card held by the workman, and give it back to him. Each workman keeps all of these cards which he obtains from time to time. Having the vaultkeeper's or the workman's signature on each card makes it easy to prove who is responsible, if the tool becomes lost. To produce a receipt signed by the vaultkeeper showing that the tool was returned the last time he had it relieves the workman of responsibility; should he not have the vaultkeeper's receipt, the responsibility is his.

Detroit, Mich. D. A. CARR.

A Chuck for Eccentric Work

Recently, while working for a prominent arms company, I had occasion to make two hardened and ground locating pins that were oval for about one-third of their lengths and round the rest of their lengths.



CHUCK FOR ECCENTRIC WORK

To make these looked like a difficult proposition, until I ran across the chuck shown in the accompanying illustration. It was new to me, and might be of interest to other toolmakers. It is used chiefly for turning up eccentric pins and knock-out pin shafts on the bench lathe, and squaring up the ends of flush pins, etc., on the surface grinder.

In the illustration, *A* is the regular bench-lathe collet. The body of the chuck *B* is made of tool steel, hardened and ground inside and out at the same setting; this is important, as the indicator is used on the outside to get the desired throw of the eccentric. The gear *C* is threaded internally to take the threaded end of the collet *A*, which is held from turning by the screw *F*, engaging the spline in the collet.

The chuck wrench, or pinion *D*, meshes with gear *C*, while the retaining plate *E* holds gear *C* in position. As will readily be seen, turning the wrench will rotate gear *C*, thus drawing down the collet and consequently gripping the work.

The chuck is fastened to the bench-lathe faceplate by the two clamps *G G*.

The oval locating pins were first ground on their centers in the usual manner. Then the ends that were to be ground oval were coppered and lines were struck at the points *a a* and *b b*. They were then placed in the chuck and the pointer of a dial indicator was brought to bear on them, care being taken to have the indicator at the same hight as the center of the bench-lathe spindle.

The chuck was then moved 0.05 inch off center, causing the needle of the indicator to travel 0.01 inch, the pin being turned in the chuck until the indicator reached its highest point. The tool-post grinder was then put in and one side of the pin ground; then the pin was turned half-way around and the other side ground.

In starting, a mark should be made on the collet coinciding with one of the lines at *b b* on the pin. By turning the pin around until the other line on the pin coincides with the mark on the collet, the pin has been turned half-way around.

Instead of laying out and centering the eccentric knock-out-pin shafts in the usual way, all that is necessary is to put them in the chuck and set the chuck over until the indicator reads twice the amount of the distance between the center of the shaft and the center of the eccentric, in this case 0.001 inch.

Ilion, N. Y. A. L. LOWE.

Repairing A Hot Feed Pump At Sea

A month or two ago, while on our usual run across the Atlantic, with a full complement of passengers and a heavy mail aboard, owing to adverse winds and seas, we had just a small margin in which to keep our time. As an extra incentive, we were on the home run, so were naturally anxious to make port as soon as possible. In such a case, as all sons of Father Neptune are aware, the highest efficiency is demanded of every unit, human and mechanical.

Fig 1

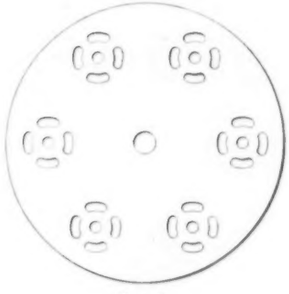


Fig. 2

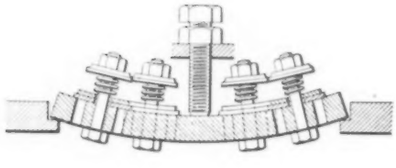


Fig. 3

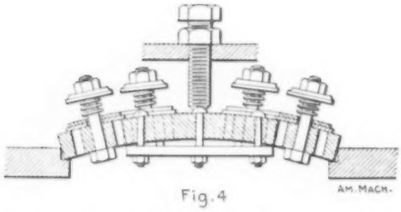


Fig. 4

REPAIRING A HOT FEED PUMP AT SEA

Two days before getting into port it was discovered that there was something wrong with the hot-feed pump, the stopping of which meant knocking about a revolution per minute off our average, as it deprived us of the use of one of the feed heaters, so that we had to use water at 126 degrees Fahrenheit instead of 230 degrees Fahrenheit, and as the symptoms became rather alarming, it was decided to shut the pump down and investigate the cause of the trouble.

After switching the feed on the auxiliary line, we found the discharge-valve seat had fractured, as shown in Fig. 1.

The chief engineer on being made aware of the accident, ordered a piece of plate to be cut so as to cover the seat. This was to be screwed to it so that the broken parts would be held together, as unfortunately there wasn't a spare valve seat in the ship.

A piece of $\frac{5}{8}$-inch plate was got out and marked off to correspond with the broken seat. While drilling out the valve seats, the idea of making the plate do without the original seat, suggested itself to the first assistant as being the speediest method of finishing the job and getting the pump in commossion again.

It was then decided to put that plan in execution, and after three hours' hard work the plate was cut, drilled and tapped, as shown in Fig. 2.

To put it in place and get the pump into working condition took about half an hour or so, and four hours after stopping it was in service again and everything seemed right, the only suspicion was that the plate might buckle under the pressure, which was about 250 pounds per square inch.

The fears of that happening were soon realized, as two hours after the pumps refused to cope with the quantity of feed water necessary, so that we were obliged to shut down again and take the plate out, which was found buckled, as shown in Fig. 3.

To straighten it out with the means at our command probably meant warping the valve seats, so we dismounted the valves from the concave side and refitted them on the convex, then added a doubling plate with 3 three-quarter inch bolts, set hard up and riveted over the ends so that the job looked like Fig. 4.

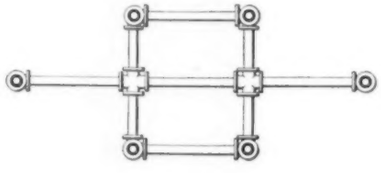
We then replaced the plate on the pump, closed it up and in spite of the delay, we made good time and safely landed passengers and mail a few hours earlier than we expected.

Halifax, N. S. C. F. M.

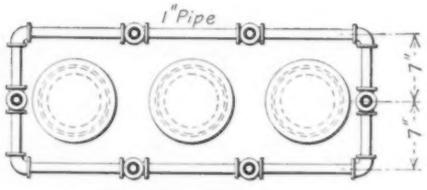
A Home-made Blueprint Apparatus

The accompanying illustration shows a simple and efficient homemade blueprint apparatus that was constructed for use in a small shop where the quantity of work did not warrant the outlay for a regular machine. It consists of a frame *A*, of 1-inch pipe and fittings; a hood *B* of sheet iron, painted white on the inside to act as a reflector; and three ordinary arc lamps *D*, suspended from the top of the frame. The hood is fastened to the frame by the straps *C*.

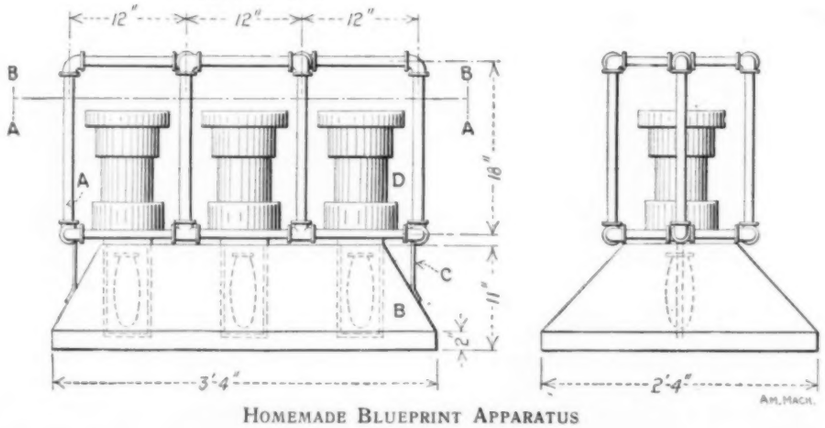
The apparatus is suspended from the ceiling over a table, and an ordinary sun



Section B-B



Section A-A



HOMEMADE BLUEPRINT APPARATUS

printing frame is placed in position under it.

The homemade apparatus will serve very well for a shop in which an electric printing apparatus is occasionally required on dark days.

Dayton, Ohio. D. C. TASH.

Labor Cost of Automatic Screw Machine Products

A table of automatic screw-machine costs is shown in Fig. 1 which can be used in any factory to give a self estimate of labor expense per 100 parts, to which it is only necessary to add the overhead expenses and cost of material to obtain the total cost per hundred parts.

6.5 HOURS SET-UP

Net Product in 10 Hours	Labor Cost per One Hundred Parts: 2,500 Lot	5,500 Lot	10,500 Lot	50,000 Lot
180	$0.3487	$0.3401	$0.3370	$0.3340
190	0.3312	0.3232	0.3193	0.3165
210	0.3012	0.2926	0.2892	0.2865
240	0.2654	0.2568	0.2535	0.2507
270	0.2378	0.2291	0.2258	0.2229
290	0.2225	0.2137	0.2105	0.2077
300	0.2156	0.2067	0.2036	0.2007
350	0.1870	0.1783	0.1750	0.1721
400	0.1656	0.1570	0.1536	0.1508
450	0.1488	0.1403	0.1369	0.1341
525	0.1298	0.1212	0.1180	0.1152
575	0.1199	0.1113	0.1082	0.1050
625	0.1116	0.1030	0.1000	0.0955
700	0.1013	0.0297	0.0895	0.0865
800	0.0906	0.0820	0.0810	0.0758
925	0.0804	0.0718	0.0687	0.0655
1050	0.0727	0.0640	0.0609	0.0578
1100	0.0701	0.0615	0.0589	0.0552
1150		0.0592	0.0559	0.0528
1200		0.0570	0.0537	0.0507
1250		0.0550	0.0517	0.0487
1300		0.0532	0.0498	0.0467
1350		0.0514	0.0482	0.0453
1400		0.0498	0.0460	0.0435
1450		0.0484	0.0446	0.0421
1500		0.0470	0.0437	0.0408
1600			0.0412	0.0382
1700			0.0391	0.0361
1800			0.0371	0.0341
1900			0.0357	0.0324
2000			0.0338	0.0307
2100			0.0323	0.0299

5 HOURS SET-UP

Net Product in 10 Hours	10,500 Lot	50,000 Lot
2,300	$0.0290	$0.0265
2,400	0.0279	0.0256
2,700	0.0252	0.0227
2,900	0.0236	0.0214
3,200	0.0216	0.0194
3,600	0.0196	0.0174
4,000	0.0179	0.0155
4,600	0.0159	0.0136
5,400	0.0140	0.0118
6,400	0.0122	0.0100

2 HOURS SET-UP

8,100	0.0087	0.0077
10,800	0.0067	0.0057
21,600	0.0039	0.0030

FIG. 1

Although automatic screw-machine operators are paid about the same rate in different parts of the country it seems that most factories experience trouble in estimating cost on the work either because they have not figured from a proper basis, or, because the time for setting up and grinding of tools was not properly allowed.

My experience has been that, in most factories, the cost of parts made on the automatic screw machines has been estimated entirely too low.

A safe estimate for the cost of operating these machines in 6 cents per hour for one machine, as the average operator, to run five machines, may be figured at 30 cents an hour. This same average would result from paying 30 cents per hour for a set-up man on ten machines, with a helper to adjust and grind tools at 18 cents per hour and one apprentice to stock the machines at 13 cents per hour.

One thing very necessary in estimating these costs is to make allowance for setting-up time; one job may take eight hours to set up and another, such as a pin or rivet, may take only two hours.

This is not usually taken care of when the office force figure up the costs and possibly this is one reason why, in many factories, the labor cost is under-estimated.

In the table, Fig. 1, it will be noticed that the costs are grouped according to the time required for setting up.

The parts on which the product is low require more time to make and also more time to set up, therefore, in the table there is allowed 6½ hours for setting up parts on which the product is from 180 to 2100, and from 2100 to 6400 five hours is allowed as the setting-up time. For parts on which the product is from 8100 to 21,600 only 2 hours is allowed for setting up as these jobs are usually straight pins, rivets, etc.

It will also be noticed that the difference in cost per 100, when the parts are manufactured in large quantities, is greatly reduced by the reduced cost of setting up. For instance, for a piece of which the net production is 700 in 10 hours, we find a cost of $0.1013 per 100 parts when ordered in quantities of 2500; but if they were ordered in 50,000 lots the cost would only be $0.0865 per 100, a difference of $0.0148 per 100. For this reason the cost per 100 on lots of 2500 is only given as far as 1100 parts a day as anything over this would probably be ordered in larger quantities.

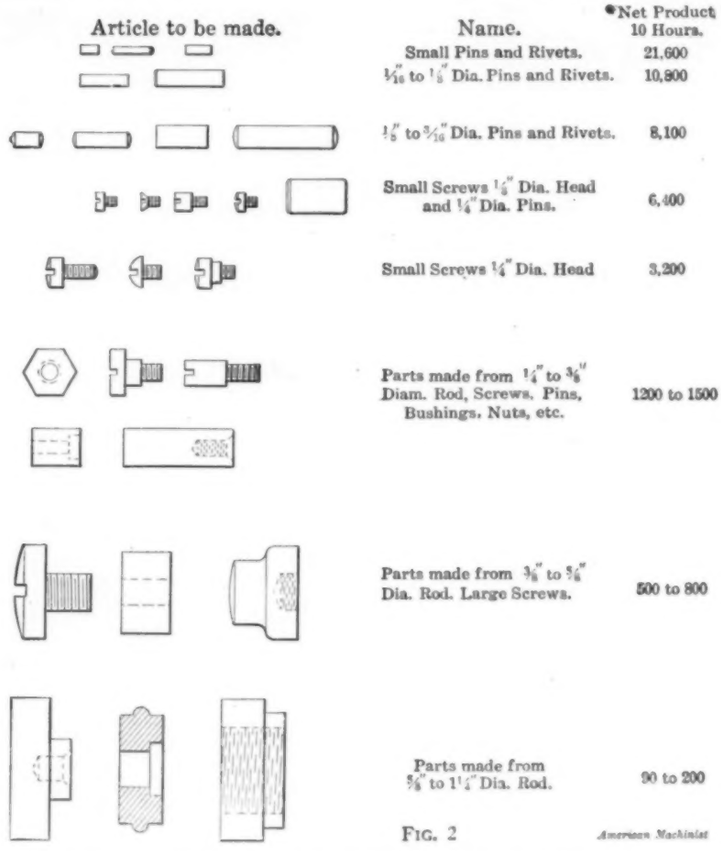

Article to be made.
Name.
*Net Product 10 Hours.
Small Pins and Rivets. 21,600
1/16" to 1/8" Dia. Pins and Rivets. 10,800
1/8" to 3/16" Dia. Pins and Rivets. 8,100
Small Screws 1/8" Dia. Head and 1/4" Dia. Pins. 6,400
Small Screws 1/4" Dia. Head 3,200
Parts made from 1/4" to 3/8" Diam. Rod, Screws, Pins, Bushings, Nuts, etc. 1200 to 1500
Parts made from 3/8" to 5/8" Dia. Rod. Large Screws. 500 to 800
Parts made from 5/8" to 1 1/4" Dia. Rod. 90 to 200
FIG. 2
American Machinist

FIG. 2. LABOR COST OF AUTOMATIC SCREW-MACHINE PRODUCTS

*Given for screw stock, add 10 per cent. for brass, subtract 20 per cent. for tool steel.

For all who are interested in screw-machine work and who do not understand what the production should be on the different parts, I have added a table, Fig. 2, which can be used in making quick estimates and will be found approximately correct. Should an engineer wish to know how many automatic screw machines will be needed to manufacture the screws, pins, etc., of an adding machine, on which the output is to be five machines a day, he can find such information in the second table.

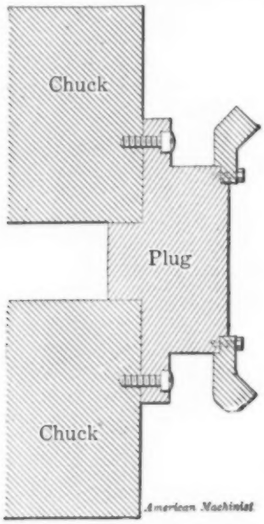
Providence, R. I. S. N. BACON.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Turning Bevel Drive Gear Blanks

Referring to the article on page 118, by J. O. Hub, with the above title, I desire to say that I have been working now over seven months upon Gisholt lathes and during that time have been employed in several first-class automobile factories. I have made thousands of driving gears, but I doubt if the superintendent of any of those factories where absolutely first-class work is required and only smoothly running and noiseless cars are built, would accept a gear that had been finished in only two operations. Every gear made in that way must necessarily not be round and out of truth.



TURNING BEVEL DRIVE-GEAR BLANKS

The best and cheapest way is to rough out the gear in the manner suggested by Mr. Hub, then put it in the lathe again, cut a very light finish in the hole and with two tools finish the web. Now get the bolt holes drilled and bolt the gear against the plug shown in the illustration and finish inside and out with wide tools.

Elyria, Ohio. FRANK J. ANDERLA.

Another Bubble Fountain

The man who made the bubble fountain, page 1130, Volume 34, went to considerable trouble and expense to procure a simple device; the same end was reached in our plant by simply turning the faucet upside down, a larger flow of water is secured. The expense of doing this is nothing compared to the other plan.

Buffalo, N. Y. F. C. LEMESSURIER.

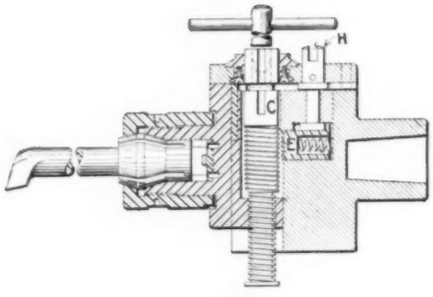
A Boring Tool of Novel Design

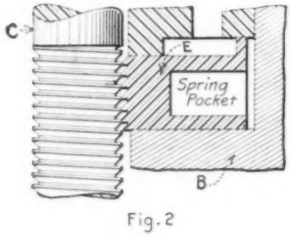
The following remarks apply to an article under the above heading appearing on page 963, Volume 34, in which it is stated that a normal movement of the tool slide of 0.001 inch for each angular advance of one space upon the part of the graduated dial, is transformed at will into an adjustment just one-fifth as coarse, or 0.0002 inch, for each dial movement from one graduation to the next. It is the purpose here to show that in the operation of this tool it is possible to lose track of the adjustments through a considerable space.

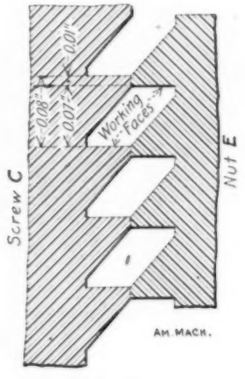
Fig. 1 is here reproduced from the original article and is given for reference. Fig. 2 shows only the parts in question, these being lettered to correspond with Fig. 1.

If we study the action in changing from the coarser adjustment to the finer one, it will be found that while this change does ultimately occur, the exact position of the dial is not known. When the thumb piece *H*, Fig. 1, is thrown over for the finer adjustment the buttress thread on screw *C* may be in such a position as to permit the half nut *E* to come into perfect mesh; but again it may be in such a position that the points of the threads on the screw *C* and half nut *E* come together as shown in Fig. 2. In this latter condition the cutting point is not moved out to its work until the screw has advanced far enough to bring the working faces into contact.

As to the amount of error possible it is hard to say, but a very conservative estimate would be as follows: If we assume that at the time of throwing over the thumb piece, screw *C* is in such a position as to cause nut *E* to ride as shown to larger scale in Fig. 3, then the 0.010 inch width of flat at top of threads would easily be sufficient to hold the nut out of mesh and as the pitch of the buttress thread is 0.08 inch we have 0.07 inch between the working faces to be taken up by turning screw *C* and this is lost motion. To take up this would require 3½ full turns of the screw or 350 spaces on the dial. Meanwhile the operator is allowing 0.0002 inch per space and hence is $350 \times 0.0002 = 0.07$ inch in error by the time his cut restarts.







BORING TOOL OF NOVEL DESIGN

J. K. MCINTYRE.

Newburgh, N. Y.

"Machine Tool" not a Misnomer

It seems to me that the article, "Machine Tool—A Misnomer," by Charles E. Hildreth (page 895, Volume 34) and also the editorial on the same subject (page 897), entirely miss the true meaning of the term, "machine tool."

The definition of "tool," as given by Mr. Hildreth, is: "An implement adapted to be used by one person and depending for its effect upon the strength and skill of the operator."

"An implement" does not necessarily mean a piece of steel. It may be any unit. A technical education is a tool for the one who has it. A battle ship is a tool in the hands of the commander.

While the piece of steel that cuts the chip is a tool when compared with the machine in which it is used, so also the machine is a tool when compared with the department. If this is true, it does not seem a long step to the term "machine tool" as applied to entire machines used in producing other machines.

Many of our common terms that are accepted and are in common usage have a derivation more obscure and illogical.

Worcester, Mass. W. C. SEARLE.

Making Brass Castings

On page 381, Volume 34, I notice the article, "Spongy Brass Castings." I have made brass castings in a small way for over forty years, mixing the metals according to the formulas in Haswell's text book, and using all kinds of scrap brass.

I grade the scrap brass altogether by the color; I take a sharp coarse file and file each piece; those which show up a rich red color I use, as there is a large proportion of copper in the original mixture. This is commonly known as red brass.

I use fine coke in melting. I take the heavy pieces of brass, heat them red hot, and then break them up into small pieces and place them in a crucible while hot. I fill the crucible full, and start the fire on the forge with a shovelful of steaming coal from under the boiler. Then I place the crucible on the fire and fill around it with fine, fresh coke, I put on the blast and keep the top of the crucible covered all the time except when charging it.

I use a small rod ⅛ inch or 3/16 inch in diameter on one end, bent over to reach to the bottom of the crucible, and thoroughly stir up the molten metal, clear to the bottom of the crucible. This rod shows me the state of the melting at all times; when I can withdraw it from the crucible without any metal sticking to it and the rod is a white heat the brass is melted.

I vent the mold thoroughly as I ram it, especially the drag; this is more important if the pattern is deep. I ram thoroughly and evenly, venting as often as I fill up the drag. The main thing is to have a clean mold, every particle of sand secured, so that, in pouring, it will not break away at some place and wash into the mold. The mold should be thoroughly vented and evenly rammed so that the metal will lie still in the mold as soon as it is poured in. As soon as the casting is firmly set, I take it from the mold and throw it into cold water to anneal.

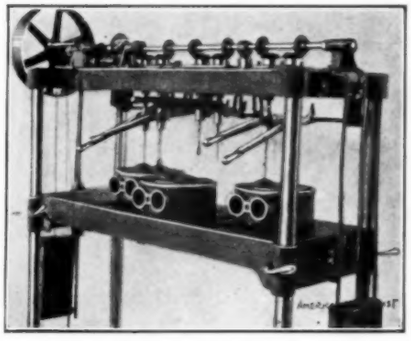
Following the above method, I have turned out fine castings from scrap brass, using no flux, not even covering the metal, while melted, with powdered charcoal. I formerly did this, but now simply cover the crucible. I use no facing on the mold and take care not to have the metal too hot to pour the work in hand. This point can only be determined by careful judgment.

Dansville, N. Y. A. J. GILMAN.

A Valve Grinder

The illustration shows a valve grinder which I have constructed at the works of the Holt Caterpillar Company, Peoria, Ill. It is now being used by the company with great success, and effects a material saving on the cost of production.

In construction, the machine consists of a bottom bed plate attached to four pipes turned to a finish, which act as supports and guides for the center plate, which supports the work. This center plate is balanced by counterweights, located at each end, and is easily raised or lowered.



A VALVE GRINDER

The center plate is suitable for either cylinders or cylinder heads, and is held in position by binding rings on each column, as shown in the illustration. The top plate carries the drive shaft and spindles; the spindles being raised by levers, held by a spring, thus allowing the work to be easily inspected.

The valves are turned by a self-centering screwdriver head, with a taper shank to fit the spindle, and are raised by a cam on shaft located underneath the valve stem, driven by a sliding-sleeve gear.

The reverse motion is obtained by a sliding clutch keyed on the spindle-drive shaft, and which meshes with two bevel gears, located near the drive pulley.

Should there be different sizes of cylinders, which would change the distance between the valve centers, the spindles can be adjusted to suit.

Anyone who has had experience with gas engines knows the difficulty in grinding and keeping the valves in a perfect seat. We have found since using this machine that the valves retain their bearing longer and also give better results in every way, over the old way of hand grinding.

Peoria, Ill. O. GENTHNER.

The Treatment of Minor Injuries

The article by W. A. Grieves, page 10, is one that should command the earnest consideration of both employer and employee, because it deals with a problem that, like the poor, we have always with us. It shows how it is possible for the two parties to work together toward a common end.

There is no one thing that is more common to shops than minor injuries and it is a thing that requires similar treatment regardless of shop location. It would seem that this one phase of shop management would receive more notice at the hands of our national associations than it has, as it is difficult to find a condition that promises greater returns than this one as a result of a little attention. Some shops, of course, have their "First Aid" boxes, but many resort to the can of turpentine, black oil, or alcohol for their antiseptics. A case in point that might have resulted seriously: An apprentice got his hand cut when a chip caught it in its coils. The injury was treated to a liberal supply of alcohol and bandaged in it. In this case, the treatment failed to improve, but rather aggravated and inflamed the hand to such an extent that a serious case of blood poisoning was narrowly averted.

There is nothing unusual about this so far, but it so happened that the shop had been notified by the purchasing agent not to use this alcohol for medical purposes, as it had been used formerly for an embalming fluid. This information came a little too late for the one case, but it practically broke up the indiscriminate use of alcohol as an antiseptic in this shop.

Of course, all shops cannot do as well as the one mentioned by Mr. Grieves, but *practically* all of them can do a great deal more than they have done so far in this direction. It is in the kindly deed done that souls are won, and there is no greater opportunity than this for the employer to show that he has the personal welfare of every employee at heart.

Urbana, Ill. E. S. STRONG.

Navy Yard Reform

Your editorial on page 37 headed "Navy Yard Reform" suggests the following comparison of conditions:

In the spring of 1898 a number of civilians were appointed commissioned officers in the Navy, and such appointments were severely criticized by some of the regular officers. They felt that such appointments cast a slur on the profession in which they had spent years of study and practice to gain proficiency; this was notwithstanding the stress of circumstances at the time, and in spite of the facts that these appointments were mostly made to the lower grades and subordinate positions, and that almost all of the appointees had seen several years of service in the naval militias of the various States.

Today the conditions are reversed, and civilian engineers (mechanical, electrical and proficiency) if they are conversant with conditions in our navy yards, feel the same way regarding the appointment of naval officers to positions which require study and practice along special lines not followed by them. These officers are educated for and trained in the art or profession of handling men, vessels and ordnance in time of war, and this training and experience does not tend to fit them for the management of the shops in the navy yards. While aboard ship they are in command of a permanent body of men, enlisted for a certain length of time, with certain specified duties to learn and perform. In the yards they have charge of a force of "civilian kings" who can work or quit the job, just as they choose, and it requires two absolutely different kinds of executive ability for the two situations.

In order to provide a force of competent officers for the manufacturing and repair establishments, a certain number of midshipmen might be selected and trained especially for such work. After the midshipmen have been two years at sea they return to Annapolis and take final examinations for graduation from the academy. At this stage of their careers they are in exactly the same position as technical graduates in civil life who have knocked and been knocked around for two years. They might at this time be given their choice, under certain restrictions, between sea service or yard service. Each would then receive his appointment to the particular line of work which he was to follow and be promoted in the usual course in his own line.

It is not meant, of course, that those who chose sea service would always be at sea. There are plenty of special-duty assignments to give periods of shore detail to the sea-going force.

Also those who chose yard service might be organized into a reserve force and assigned to positions on the different craft which were laid up in reserve at their yards. Occasional periods of drill or short cruises could be arranged for these vessels and thus they would be saved from deterioration and in case of war these officers could be assigned to the larger ships, naval-militia officers and men to the smaller vessels and civilians appointed to the places vacated at the yards.

Westerly, R. I. H. L. SMITH.

Partial Gear Guard Ordinarily Enough

In the article, "Safeguards for Gears," by John Bailey, page 892, Mr. Bailey is perfectly right in stating that complete gear guards are better than partial ones. But with the present competition in the press trade, it seems impossible to charge enough to cover the extra expense of such guards. Doubtless, any of the press builders will cheerfully put them on to order, charging a reasonable extra price for them. I have done this on several occasions.

With the partial guard shown in Mr. Bailey's illustration, especially if it is made considerably wider than the gears, as it should be, there is not much danger of a man's hands' being drawn between the gears and crushed, unless, indeed, he thrusts his fingers endwise between the teeth and lets them be carried around beneath the guard. In the accident referred to, the sufferer probably did something of this kind.

In any case, it is a careless act to clean mechanism of this kind while in motion. There are many other places, both on presses and machine tools, where such cleaning is dangerous. The wiping off of grease should be done always when a machine is at rest.

Bridgeton, N. J. OBERLIN SMITH.

Continuous or Intermittent Cuts

H. M. Wood's article on page 1085, Volume 34, does not shed much light on the original question as to "why can turning be done at faster speeds than planing?" but it does appear to uphold our contention "that either planing or turning can be done at higher speeds where the cut is intermittent than when it is constant." It would appear that your theory, the shock of the tool's entering the work, would not meet with universal acceptance.

Work can be done in a shaper without the shock of the tool entering the work; at least in the ordinary crank shaper, because of the tool having a moment of reverse when there is no motion. If the work is set so as to just allow the tool to clear, the tool will enter at almost zero speed and accelerate through the work without any shock to speak of. In the case of a shaper or planer, I believe the elimination of the shock is of more value to the machine itself and the work than to the cutting tool, and that is why a faster average speed can be maintained with the accelerating stroke than with the even cutting speed.

It appears to the writer that the position of the tool to the work would have a great deal to do with results. It seemed that there was more of a scraping effect on the planer than on the lathe, on account of the circular shape of the work in the latter as compared with flat work, but along comes the machinist with the claim that he can take the same kind of a chip off with a planer as with a lathe.

Taking cast iron of equal hardness, the same quality of cutting tool with the same clearance, entering the work at the same angle, and there would not seem to be any reason why the same speeds could not be maintained on one machine as on another. What is the answer?

Cincinnati, O. A. W. O. WATCHER.

A Plea for Straight Piecework

H. A. Pettibone's article on the above subject, on page 126, reminds me of a conversation I recently had with the superintendent of a large engine-building concern where piecework is done. Talking of piecework prices, he said to me:

"That job on the big boring mill is paying the operator $7.50 per day. Do you think I ought to cut the price?" In that part of the country the average boring-mill hand gets about $2.75 for a day's work, so at first glance it did seem that there was something wrong with the rate. Not wishing to say anything which might appear foolish, I asked if there were not "extenuating circumstances," as the judges say, to which the superintendent replied:

"Those pieces are large, difficult to handle and to hold. If I were to give them at the same rate to any other man in the shop he could possibly, doing his very best, make a dollar and a half or two dollars a day. It would take about four average men to get out the same amount of work. These four men would require four big boring mills costing in the aggregate over $30,000 and occupying over 2500 square feet of floor space. Then there is the power to run them, the tool equipment, etc. Figure it out for yourself and you'll find we are not paying too much. Over and above all this the man is satisfied. If we cut his price down he would be disgruntled and the chances are we would transform a good man into one who would soldier on every job on which he got a chance to do so. Just bear in mind that keeping the pay roll down is not always the most important thing in running a shop."

New York. E. A. DIXIE.

Backing Off Spiral Fluted Hobs

At page 339, Volume 34, Richard T. Wingo presents to us his method of approaching the problems in connection with the backing off of spiral fluted hobs. Having gone over Mr. Wingo's article I would like to compare methods and also refer to certain difficulties that are met in connection with hob production that I have not seen discussed before.

Now, there is an elementary geometric truth, that similar triangles have similar sides proportional. To prove this, I have in Fig. 1 reproduced his diagram (in heavy lines) producing BE to D, and erecting a perpendicular at C intersecting BD at D, and since BC equals the circumference of our hob, and the line BED represents the spiral flute, then it follows that CD will represent the lead of the spiral flute. Now from the diagram it is obvious we have a case of similar triangles, because, when two straight lines intersect one another, the vertically opposite angles are equal, therefore Θ equals Θ; and since AB is parallel to DC, if a straight line fall on them (DB or AC) then the alternate angles are equal and thus β equals β and ϕ equals ϕ_1 and this being so, to

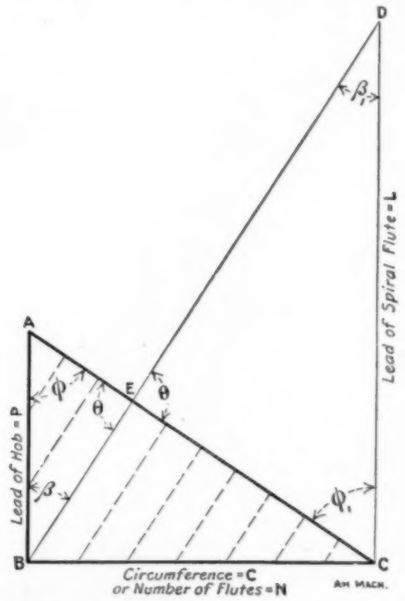


FIG. 1. BACKING OFF SPIRAL-FLUTED HOBS

find the lead of the spiral groove we only have to compare similar sides, for:

$$DC : AB :: EC : AE,$$

therefore:

$$DC = \frac{AB \times EC}{AE}.$$

Now

AC represents the desired ratio $= R$,
EC represents (in the same units) the number of flutes in the circumference $= N$,
AB represents lead of hob $= P$,
and
$AE = R - N$

therefore to find lead of spiral groove, knowing the other factors, we have, as given before

$$L = \frac{P \times N}{R - N}, \qquad (3)$$

and all the other equations come out in a similar manner.

For instance, required R, knowing lead of hob P, also lead of spiral flute and number of flutes.

Here, from the diagram by similar triangles we see:

$$EA : CE :: AB : DC.$$

$$\therefore EA = \frac{CE \times AB}{DC} = \frac{N \times P}{L},$$

but

$$R = CE + EA,$$

substituting for EA, then

$$R = CE + \frac{CE \times AB}{DC}$$

$$= CE\left(1 + \frac{AB}{DC}\right),$$

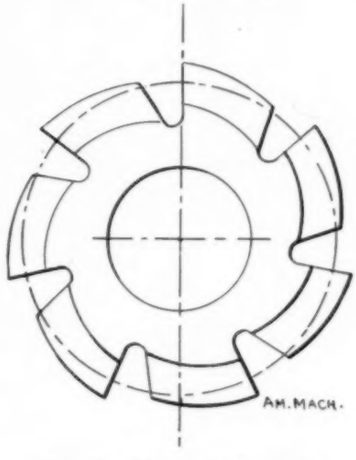


FIG. 2. HOB WITH FLUTES

therefore

since $= CE = N$

$$R = N\left(1 + \frac{P}{L}\right). \qquad (2)$$

For the case where we require to find the lead of the spiral flute that will be normal to the thread, it is obvious that all the angles at E will be right angle, therefore to compare angles from the diagram it will be seen ABC is a similar triangle to BCD, consequently

$$DC : BC :: BC : AB,$$

thus

$$DC = \frac{BC \times BC}{AB},$$

therefore

$$L = \frac{C^2}{P}. \qquad (1)$$

Now to apply the formula. Taking the case presented in Mr Wingo's article, we have

Hob, pitch diameter $= 2.125$ inches,
Lead of hob $= 4.5$ inches,

Number of teeth in circumference $= 7$, the rest of the data does not concern the problem. In the first case, since it is desired to have a ratio of 10, then the unknown is the lead of flute, and for this we have from (3)

$$\text{Lead of flutes} = \frac{\text{lead of hob} \times \text{number of flutes}}{\text{ratio} - \text{number of flutes}}$$

$$= \frac{4.5 \times 7}{10 - 7} = \frac{31.5}{3} = 10.5.$$

This is the "busy man's" method.

Taking the second case, which is the same hob, but flutes required at right angles, or normal to thread. In this case we must first find the lead of the spiral flute. This we get from (1) thus.

$$\text{Lead of flutes} = \frac{(\text{circumference})^2}{\text{lead of hob}}$$

$$= \frac{(2.125 \times \pi)^2}{4.5} = 9.9055.$$

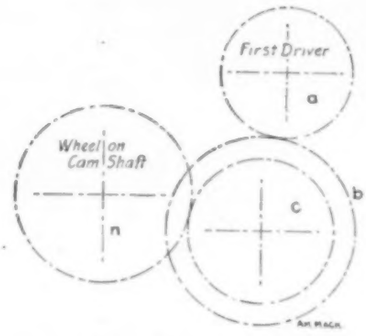


FIG. 3. GEAR TRAIN FOR BREAKING OFF HOBS

Nearest lead to this, cut say on a Brown & Sharpe miller, *without making any special wheels*, $= 9.9$ inches.

Taking this, our ratio is given by formula (2)

$$R = N\left(1 + \frac{P}{L}\right) \qquad (2)$$

$$= 7 + \frac{7 + 4.5}{9.9} = 10.1818,$$

and this involves an error of $\frac{1}{127,000}$ when using the wheels mentioned, or approximately equal to a taper of $\frac{1}{1000}$ of an inch in 80 inches, which is somewhat nearer than we usually work. By the way, what makers of lathes supply a 83-toothed wheel? And further, who supply 103-toothed wheels with their millers. If Mr. Wingo makes a pair of wheels for every hob he makes it will come a little expensive.

It is astonishing what a lot of shop problems there are which can be solved very simply by a knowledge of the fact that similar triangles have similar sides proportional, and the young machinist will do well to cultivate this simple geometric truth. Unfortunately Euclid is taught to boys when they are at such an age that it is useless to them, and later in life they remember their previous

torture, and pass it by when they see it in the form of geometry.

Multiple Pitch Hobs

There is a good reason why care should be taken in the selection of the wheels for backing off hobs of multiple pitch. When designing hobs with multiple pitches it is sometimes imperative that an odd number of flutes be put in, and this may lead to trouble on the backing-off lathe.

It is usual when cutting worms of multiple pitch, either to have a divided driving plate and turn the work round into a different position for each pitch, or to move the gear wheel on the screw round the necessary number of teeth. A similar procedure is followed on the backing-off lathe when doing hobs, but a further, and sometimes more complicated, move is required, because the wheels actuating the cam must be moved for a similar reason, and it is here that trouble may arise.

If we refer to Fig. 2, which is an end view of a hob with 7 flutes, it will be seen that there is no chance of measuring the diameter of each pitch of such a hob because we have a space on the opposite side to a tooth (see vertical center line); this being so, in multiple pitch hobs we can only insure each pitch being the same diameter by trusting to the tool and the machine, and, as when we move our tool from one pitch to the next, the cam will cause the tool to jump in the same place, instead of somewhat sooner, we must of necessity move the cam shaft round the necessary amount to correct this.

Any dodging of this will only lead to inaccuracies but if this fact has been kept in view when selecting the wheels to give the proper ratio no trouble will be met.

For machines that have a single rise cam the procedure is the same as for cams having multiple rises.

The formula to give the number of teeth to move the cam-shaft wheel round so as to bring the jump into its proper position, is:

$$x_n = \frac{N}{C} \times \frac{n}{T} \qquad (4)$$

where

x_n = The required number of teeth to move cam-shaft wheel.
n = Number of teeth in cam-shaft wheel,
N = Number of flutes in hob,
T = Number of pitches in hob,
C = A constant for the machine, and may be taken as the number of rises on the cam.

From what has been said it will be seen how important it is that care should be taken to have one wheel in the set that will divide out, and preferably, on the cam shaft. For example: Required to know how many teeth to move the cam-shaft wheel for a double-pitch hob having 7 flutes, when the wheel on the cam shaft has 72 teeth, and the cam has 4 rises; then from (4)

$$x_n = \frac{7}{4} \times \frac{72}{2} = 63 \text{ teeth},$$

and for a similar hob, but with triple thread, we get

$$x_n = \frac{7}{4} \times \frac{72}{3} = 42 \text{ teeth}.$$

Now it will sometimes happen that the wheel on the cam shaft is not exactly devisable; for instance, take the example just used, but assume quadruple pitch, then we get:

$$x_n = \frac{7}{4} \times \frac{72}{4} = 31\tfrac{1}{2} \text{ teeth},$$

and it is obvious that this cannot be used so we must move one of the other wheels. If we look at Fig. 3, which is a diagram of a set of wheels, we shall see that we can change the cam-shaft wheel with first follower b without changing the ratio, and then perhaps the new cam-shaft wheel will divide out by formula (4); if it does not then the first driver a must be tried. Now a study of the diagram, Fig. 3, will show us, that the number of teeth to move the first driver a will be given by multiplying the previous formula (4) by the ratio of the teeth in the two intermediates, consequently to find the number of teeth to move the first driver a we have:

$$x_a = \frac{N}{C} \times \frac{n}{T} \times \frac{b}{c}, \qquad (5)$$

where b and c represent the number of teeth in those wheels shown in the diagram, Fig. 3, with other symbols as before.

Application to a Special Case

Having derived the various equations, let us see what happens in a special case. Taking Mr. Wingo's first case (for flutes at any angles) he gives number of flutes = 7, number of starts in hob = 12 and wheels as $\frac{60 \times 80}{90 \times 64}$ and since we are told that the machine ratio is 12 we may assume the number of cam rises to be four. Then putting the 90-toothed follower on the cam shaft we have from (4)

$$x_n = \frac{7}{4} \times \frac{90}{12} = 13\tfrac{1}{8} \text{ teeth}.$$

This won't do, so trying with the 64-toothed follower on the cam shaft, we get:

$$x_n = \frac{7}{4} \times \frac{64}{12} = 9\tfrac{1}{3} \text{ teeth}.$$

As we cannot move a portion of a tooth we must try to move the first driver. Putting this as 60 teeth, we have from (5)

$$x_a = \frac{7}{4} \times \frac{90}{12} \times \frac{64}{80} = 10\tfrac{1}{2} \text{ teeth}.$$

Now let us change the drivers and put 80 as the first driver, we now have:

$$x_a = \frac{7}{4} \times \frac{90}{12} \times \frac{64}{60} = 14 \text{ teeth}.$$

So that if we arrange the wheels so that 80 is the first driver and 90 is on the cam shaft, every time we shift threads in the hob we must move the first driver 14 teeth and this brings it right without any dodging.

As a further example let us take the set of wheels given in Mr. Wingo's second case, i.e.,

$$\frac{65 \times 52}{83 \times 48},$$

putting 48 on the cam shaft we get

$$x_n = \frac{7}{4} \times \frac{48}{12} = 7 \text{ teeth},$$

so that cam-shaft wheel must be moved 7 teeth to bring the backing-off reciprocations, or jumps, into correct relationship. It is generally easy to select a set of wheels that will divide out with one of the formula's, when once the idea of changing the position of both driver and follower is grasped.

Walter G. Groocock.

London, England.

Continuous Machine Lubrication

We are much interested in the article by John R. Godfrey on page 103, Volume 34.

As you are aware, we have been advertising our millers lubricated with a pump for a number of years back and he confesses that he has never seen anything of this sort until he attended the Master Mechanics convention at Atlantic City where the Bullard Machine Tool Company had an exhibit embodying this principle.

E. J. Kearney.

Kearney & Trecker Company, Milwaukee, Wis.

Catalog Filing

I was interested in Mr. Johnson's article, "Index Catalogs and System for Filing," page 1084, Volume 34.

We have about 1350 catalogs in our file and use cabinets, having drawers 10x14 inches, to keep them in.

Manila-paper folders numbered consecutively fit the drawers and when a new catalog is received, a number is written on the corner of it and it is put into one of the folders. Two cards are put into the index, one for the name of the firm and one for the article described.

This method of filing takes care of the catalogs of different sizes, as the cabinets are large enough to take care of all sizes. They are protected from dust and dirt and at the same time any desired catalog can be found almost instantly.

We have a sectional bookcase for the accommodation of the large books issued by some supply houses.

W. Alton.

Philadelphia, Penn.

Wooden Dies for Sheet Steel Work

By T. A. Sperry

Some of the forms in which wooden construction can be applied to die work. A description of some durable wooden dies that were made quickly and with little expense.

There are very few mechanics who appreciate the possibilities of wooden dies, the ease with which they can be made and worked, and the saving that can often be effected by their use. They are especially suitable for embossing work that requires only a comparatively small number of parts.

Fig. 1 shows a very simple example of such work. This die was made for embossing three ribs (one at a time), about 5/8 inch long and 3/8 inch high, longitudinally on a box cover of 24-gage, galvanized iron about 18 inches long.

As will be seen, the die proper, made of a piece of hard maple about 5 inches wide, 2 inches thick and 25 inches long, is inverted, and attached by screws (not shown) to the upper ram of the press. The punch proper, of hard maple, 4x5/8x

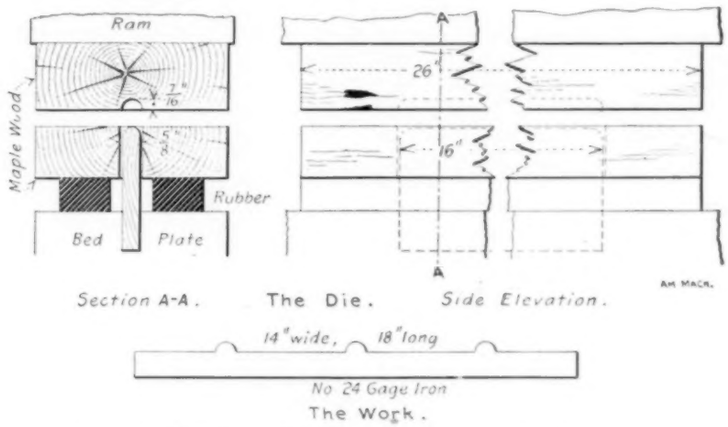


FIG. 1. A SIMPLE RIB-EMBOSSING DIE AND ITS WORK

16 inches, rests in a recess in the bed of the press, and works through a slot in the press board, also of maple, 2x5x25 inches, which is supported on the rubber strips shown.

These rubber strips, in this case 1 inch thick by 1½ inches wide by 24 inches long, are the key to the success of the die. The top to be embossed is placed in position on the press board, which stands a little above the top of the punch, so that when the ram is brought down it pinches the metal hard before the punch begins to act. This pinching is absolutely necessary in order to prevent the cover from wrinkling and twisting under the strain of the punch.

Fig. 2 shows four other examples of embossing done in exactly the same way, and gives an idea of the size and range of work that can be handled. It shows: A simple rectangular embossing *A*, 16x24 x5/8 inches in No. 20 iron; a more complex cross-shaped embossing *B*, 18x24x ½ inches; a rectangular ring *C*, 12 inches across by 7/16 inch high; and a double bead *D*, in 22-gage iron about 18 inches long. This is heavy work, and is done under a drop press having a steel drop weighing 4000 pounds falling from 16 inches to 36 inches. Every die is made of three pieces of maple and with a rubber-supported press board.

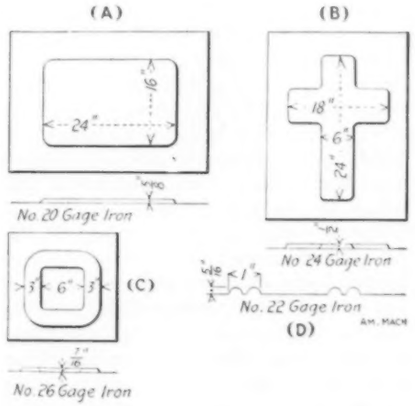


FIG. 2. SOME EXAMPLES OF EMBOSSING DONE WITH WOODEN DIES

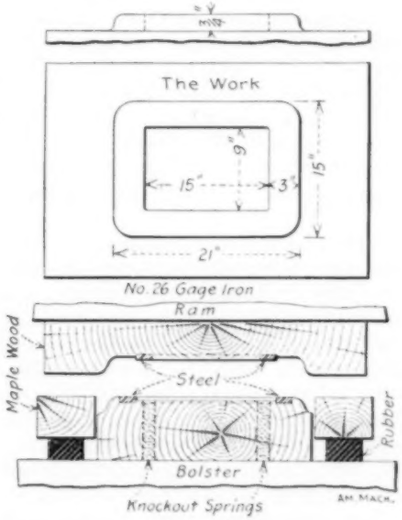


FIG. 3. A COMBINED SHEARING AND EMBOSSING DIE

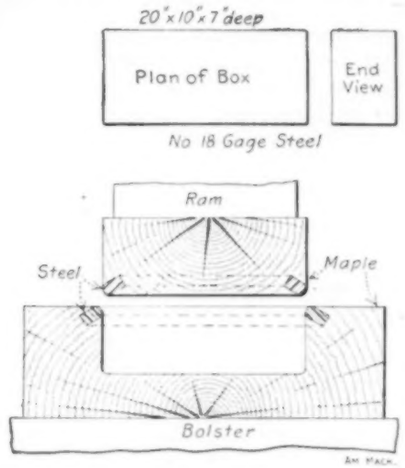


FIG. 4. A BOX-FOLDING DIE

These are good illustrations of the relative durability of such dies, as one die of the cross form *B*, and slightly smaller, has formed over 6000 pieces under this drop, and is still good for use. This particular die was made complete by one patternmaker in a half-day's time, at a labor and material cost of about $4.50, including the rubber.

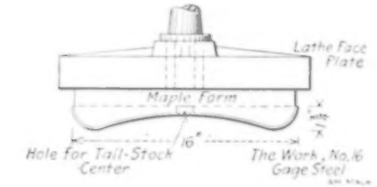


FIG. 5. A MAPLE FACEPLATE FOR SPINNING METAL CHAIR SEATS

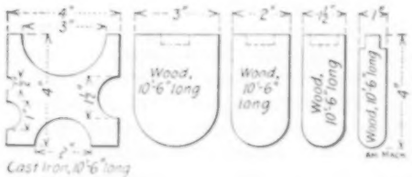


FIG. 6. CAST-IRON DIE BLOCK AND WOODEN PUNCHES FOR LONG WORK.

Fig. 3 shows a rather exceptional die, in that it is not only an embossing die, but shears the sheet at the same time, by means of the inserted steel strips. The work performed is shown above the die; it consists in cutting out a rectangular panel 9x15 inches and embossing a rib 3 inches wide by ¾ inch high around this opening, the sheet being No. 26 steel. Four coil springs knock out the sheared panel, the embossing being practically completed before the shearing is done. This work is done under the same drop process as the above, and is fairly satisfactory; however, it would not answer for very accurate work.

Fig. 4 shows a box-folding die made on somewhat the same principle, the folding being done by steel strips inserted in wooden holders. This die folds the four sides of a simple rectangular box of No. 18 sheet steel, the four corners of the blank being cut away previously, at one operation. The corners are afterward secured by angle corners rive' 1 on.

Fig. 5 can scarcely be called a die, but is worthy of mention in this connection. It is a built-up maple form, three thicknesses of board glued together with the grains crossing at 120 degrees. It is attached to the faceplate of a lathe for spinning steel chair bottoms of No. 16-gage steel. The work is centered and held in place by a special tailstock center working in a hole previously punched in the center of the piece. The spinning is done in the usual manner.

Fig. 6 illustrates a combination of a cast-iron die and wood formers for making semicircular troughs, such as eaves troughs, or moldings of various sizes. The especially noteworthy feature of these forms is their length of 10 feet 6 inches each, the press in which they are used being a 10½-ft. press. The single cast-iron die serves for the five sizes of formers.

Fig. 7 can hardly be classed as a wooden die, as the only wood entering into its construction is the rectangular block around which the work is formed. The device is a hand-operated, box-folding fixture for bending No. 16-gage steel boxes about 8x12x5½ inches deep. The corners of the sheet are previously cut to shape, the sheet is laid on the fixture bed which opens out perfectly flat, and the wood form is brought down hard by means of a screw and handwheel (not shown). The two ends of the boxes are then bent up by means of the hinged wings attached to the ends of the bed plate. The end wings are then dropped again and the sides are bent up by means of the side wings.

These side wings are held in place by a clamp (not shown), and the ends of the sides are folded over the box ends previously bent up, by means of hinged end pieces attached to the side wings. All wings have two handles cast to them, for extra leverage, and are prevented from dropping too far when released by cast-on lugs. After stripping the box from the form block, the ends are riveted, making a substantial, if not particularly ornamental box. With this device, these boxes are made in lots of one or more thousand, and are found very satisfactory.

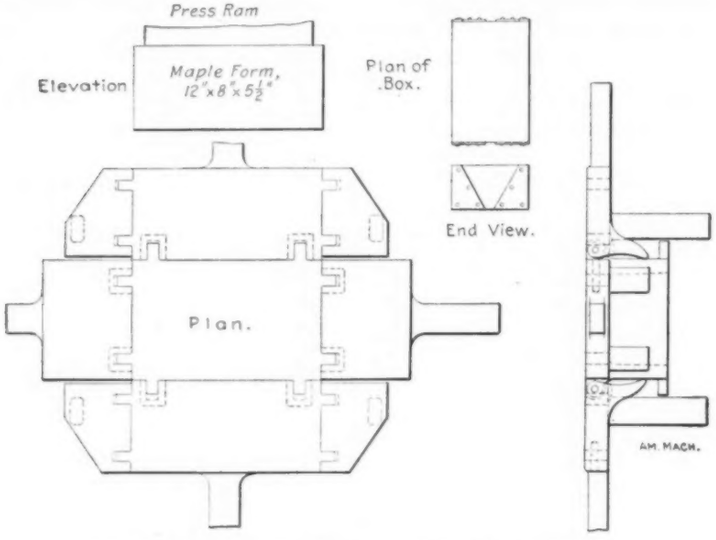


FIG. 7. BOX-FOLDING FIXTURE WITH WOODEN FORM

This article does not pretend to cover the entire field or possibilities of wood construction applied to die work, but merely indicates some of the forms in which it is being and can be successfully and regularly used in a commercial way today. The factory from which most of these sketches were made is employing several hundred men, and works extensive use of these and similar wooden dies and fixtures.

The satisfactory results obtained seem to indicate that a more extended use of such construction is desirable.

Drivers for Starting Stubborn Screws

BY ANDREW WEBSTER

Most of us have had trouble with the slot-head screw that won't come out. The illustrations show two screwdrivers that are good starters for stubborn screws. What is wanted is to keep the part that engages the screw from leaving the slot. Fig. 1 is made for work that can be conveniently handled between the vise jaws.

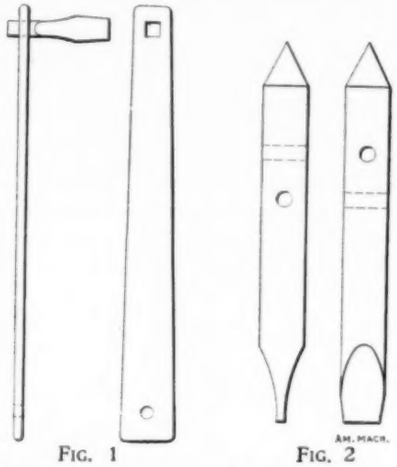


FIG. 1 FIG. 2

DEVICE FOR STARTING STUBBORN SCREWS

Fig. 2 is intended for heavier work and is controlled by a back center. If the screw is not near enough to an edge to furnish a fixed support, form a bridge over the screw. Supply plenty of top weight, and, of course, a center hole to receive the conical end of the screwdriver.

Effect of Paint on Radiators

From some tests made at the University of Michigan the results seem to indicate that aluminum and copper bronzes so generally used in coating radiators, materially affect their efficiency.

In the tests made, two radiators exactly alike in their unpainted condition fresh from the factory showed practically the same condensation. One radiator was then painted with two coats of copper bronze and was found to have its heat radiation diminished by 24 per cent. below that of the original cast iron. Another pair of copper bronze coats decreased the radiation by 25 per cent.

Further experiments showed that in general aluminum, copper and metal pigments in the bronzes reduce the heat radiation. This is probably largely due to the composition of the bronze and partly to the vehicle which contains this pigment. The experiments demonstrate that the effect is largely surface effect and not conduction effect. The results show that the loss of heat from radiators depends largely upon the surface effect and to only a small extent upon the conduction of heat through the metals.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

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Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For July,* 1911 *(American weekly, American monthly, English weekly and German weekly), total,* 111,250.

Of this issue 23,000.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 213

Index

The index to Volume 34, first-half 1911, is being mailed with this issue. Those who desire an index and are not on our regular subscription can secure one for the asking.

For convenience in reference each half of the year will have a separate volume number, instead of dividing the volume in two parts as heretofore.

The Progress in Accident Prevention

Those who are considering the question of safeguarding machinery will find much of interest in the report of the commission on Employers' Liability to the legislature of New York.

The General Electric Company has ordered "all exposed gears to be covered" on all machines bought for over four years. They also have 15 men whose duty it is to make and attach guards under the supervision of a man who makes this his sole business. In addition to this, they have organized a committee with representatives from plants in Schenectady. Lynn and Pittsfield, which is responsible for the proper guarding of machine and wood-working tools, exhaust equipment to prevent injury from dust or noxious fumes, and other similar work.

The testimony makes it very clear that the accident problem is not all one sided: Men have not become educated to the use of guards in many places, especially on wood-working machinery, and sometimes remove them when the foreman is not around.

Many men also object to wearing goggles to protect the eyes in the shop, although they would probably jump at the chance of wearing them in an automobile. It is generally a case of not liking to appear afraid of injury or a sort of pride in personal appearance.

But these feelings must be removed by educating all parties to a realizing sense of their responsibilities.

The problem of securing suitable inspectors is also brought out very clearly and involves more difficulty than might be imagined. For, in spite of the best of intentions, politics are bound to play a part for the present, and it will require time to educate men so as to secure the best results for all concerned, or to secure men who have the requisite knowledge and the judgment which should go with it for such work.

It is well to bear in mind that we have much to learn along these lines and we shall learn faster if we can avoid undue impatience and try to help in every way we can.

American Machinist

A Questionable Saving

It would be difficult to find anyone who would admit that he did not believe in considering quality as well as price when purchasing materials or supplies. But it is questionable if this belief always influences decision when castings are being bargained for. A correspondent sends us the following illustrative case:

Two 36-inch lathe beds, 20 feet long, were cast from one pattern, but in different foundries. One weighed 6100 pounds; the other 6800 pounds. The second cost a quarter of a cent a pound less than the first, but the total costs of the castings were practically equal.

The real difference appeared in the planing. After planing the first weighed 5950 pounds; the second 6250. Four hundred pounds more chips were cut from the heavy bed than from the light one, to bring it to finished size. Now, the loss on 400 pounds of castings reduced to chips is less than $10 but it was supplemented by other losses. The cut in places was nearly an inch deep. The feed had to be reduced to suit these deep places. For part of the way the machine was underworking; that is, taking a shallow cut at such a rate that it could take the heavy cut when it occurred. The first bed was planed in 22 hours; the second required 40 hours. The actual cost per hour for man and overhead charges was $1. Thus there was actually thrown away $18 in labor and shop expenses for the cut of one-fourth of a cent per pound on the price of the casting; besides the advantage of the reduced price per pound was never realized, for the foundry swelled the casting to cover the reduction.

This case well illustrates a penny wise and pound foolish policy. The question of quality must be most carefully considered when a reduction in price is contemplated.

On many classes of work we know that it is not difficult for a molder to bed his pattern in the sand so gently that the casting will swell, in fact must swell, and thereby increase the amount of finish allowed on the pattern itself. This method is sometimes resorted to when molding for a casting that it is difficult to produce true and straight. The oversize helps to get a casting that will "clean up."

This brings out the wisdom of specifying that excess weight beyond a certain percentage will not be paid for. This is a method used in some government specifications. A frequent allowance is 5 per cent. above the estimated weight; that is, if the casting does not weigh more than 5 per cent. above its estimated weight, it is paid for as weighed. The weight in excess of 5 per cent. above the estimate is not paid for, but is a loss to the person furnishing the casting.

Besides the justice of such a course, it tends to the production of castings that do not have to be machined down to the spongy interior in order to work to the drawing.

The Cost of Poor Lighting

As an indication of the actual dollars and cents cost of poor lighting facilities, we cannot do better than to quote a manufacturer of textile goods. His factory was probably as well lighted as the average before he put in the best system of lighting he could find, and in his case the results were apparent at once.

His production during the hours of artificial lighting at once increased about 20 per cent. over the former amount.

Under the former conditions they had found it necessary to make an allowance for spoiled work, which was entirely wiped out by supplying the proper light.

While these results might not be duplicated in the average machine shop, it is well to consider what an increase of 10 or 5 per cent. would mean, as well as the illumination of the uncertainty as to quality, which is ever present with the usual night work.

Buying Oil on Heat-value Basis

We have frequently pointed out the advantage to both buyer and seller attending the use of heat-value specifications in the purchase of coal. Their use has been so successful that a demand has arisen for similar specifications, based on careful tests, to govern the purchase of fuel oil. Therefore, the Bureau of Mines has issued a technical paper on "Specifications for the Purchase of Fuel Oil for the Government," which also contains directions for sampling oil and natural gas.

These specifications establish the heat value of the oil—that is, the number of heat units the purchaser obtains for a given price per unit quantity of the fuel—the physical character of the oil, its flash point, its burning point, and the quantity of the contained extraneous matter. While this bulletin is intended primarily for the guidance of government officials, it will be of service to all persons who buy such oil in quantities.

The general specifications for the purchase of fuel oil are as follows:

In determining the award of a contract, consideration will be given to the quality of the fuel offered by the bidders, as well as the price. Should it appear to be to the best interest of the Government to award a contract at a higher price than that named in the lowest bid or bids received, the contract will be so awarded.

Fuel oil should be either a natural homogeneous oil or a homogeneous residue from a natural oil; if the latter, all constituents having a low flash point should have been removed by distillation; it should not be composed of a light oil and a heavy residue mixed in such proportions as to give the density desired.

It should not have been distilled at a temperature high enough to burn it, nor at a temperature so high that flecks of carbonaceous matter began to separate.

It should not flash below 140 degrees Fahrenheit in a closed Abel-Pensky or Pensky-Martens tester.

Its specific gravity should range from 0.85 to 0.96 at 59 degrees Fahrenheit; the oil should be rejected if its specific gravity is above 0.97 at that temperature.

It should be mobile, free from solid or semisolid bodies, and should flow readily through a 4-inch pipe 10 feet in length at ordinary atmospheric temperatures, and under a head of one foot of oil.

It should not congeal nor become too sluggish to flow at 32 degrees Fahrenheit.

It should have a calorific value of not less than 18,000 British thermal units per pound; 18,450 units to be the standard. A bonus is to be paid or a penalty deducted according as the fuel oil delivered is above or below this standard.

It should be rejected if it contains more than 2 per cent. water.

It should be rejected if it contains more than 1 per cent. sulphur.

It should not contain more than a trace of sand, clay or dirt.

Each bidder must submit an accurate statement regarding the fuel oil he proposes to furnish. This statement should show: The commercial name of the oil; the name or designation of the field from which the oil is obtained; whether the oil is a crude oil, a refinery residue, or a distillate; the name and location of the refinery if the oil has been refined at all.

Copies of this paper, "Technical Paper No. 3," may be obtained by addressing the Director of Bureau of Mines, Washington, D. C.

New Publications

WOODWORKING FOR AMATEUR CRAFTSMAN. By Ira S. Griffith. One hundred and twenty-one 4½x6½-inch pages; 127 illustrations; no index. Popular Mechanics Company, Chicago, Ill. Price, 25 cents.

This little book is one of the *Popular Mechanics* Handbooks series, and as its name implies, is written for the mechanically inclined boy or amateur woodworker. In its 16 chapters it takes up the selecting of stock, laying of it out, use of all the common wood-working tools, and plans and instructions for six simple articles of furniture, running from a bird box to a music cabinet.

CENTRIFUGAL PUMPS, THEIR DESIGN AND CONSTRUCTION. By Louis C. Loewenstein and Clarence P. Crissey. Published by D. Van Nostrand Company, New York, 1911. Cloth; 435 pages, 6x9 inches; 317 illustrations. Price, $4.50 net.

The preface states: "The object of this book is to present to those interested in centrifugal-pump manufacture and design and to technical students a clear presentation of the fundamental principles involved, a full explanation of the calculations necessary in securing the best efficiencies and performance, a proper understanding of the constructive details of the various types, the best methods of manufacture and a correct knowledge of the proper proportions of pump parts in order to secure safe and smooth operation."

Unfortunately, however, the book contains but little by which the everyday problems of the pump manufacturer may be solved.

The authors have translated the work of Fritz Neumann on "Die Zentrifugalpumpen" and have adopted both the theory expounded therein and the method of calculating impellers, which is totally unsuited to the present needs of the pump designer.

They find that the impeller belongs to a certain class which becomes characterized by certain coefficients such that the number of revolutions for any quantity and head of water can be found. The speed thus determined may be, except by chance, totally out of reach of the prime mover at hand, in which case the whole guessing process has to be done over.

The authors believe strongly in the efficiency of guide vanes surrounding the periphery of the impeller; they say: "The object of the guide vanes is to reduce gradually, with minimum shock losses, the absolute exit velocity W_a and thus transform as much as possible of the velocity head $\left(\frac{W^2_a}{2g}\right)$ into pressure." Here is an unfortunate confusion which is found throughout the book; head is pressure, and a guide vane is a plate curved to suit the design and intended to deflect the course of a stream. What is meant is that guide passages, commonly known to all pump designers as diffuser passages, are so shaped as to render possible a gradual reduction of the velocity of the water.

From page 167 to page 185 there is a rather strenuous study of the strength of the impeller considered as a rotating body. One fails to see how the elaborate theory of the resistance of the impeller can help the pump maker, and particularly so since this theory does not even apply to the design of the multistage type of impeller.

The authors consider the shape of blades dependent upon their number, when theoretically the impeller is just as efficient, barring frictional losses, with only one as with 10 or 12 blades.

While the theoretical part of the book appears weak, the remainder is exceedingly interesting and gives a very good idea of the present state of the art both in Europe and in this country.

Personals

Ralph N. Lapointe has become broach expert of the Lapointe Machine Tool Company, Hudson, Mass., and will also be in charge of its reamer department.

D. W. Patten, for the past five years with Schuchardt & Schütte, New York, resigned and is now connected with Marshall & Huschart Machinery Company, Chicago, Ill.

Frank F. Cutting, for a long time associated with the Hill, Clarke & Co.'s interests, has been elected president and general manager of the Lapointe Machine Tool Company, Hudson, Mass., which company has recently undergone a reorganization.

M. K. Patten, formerly in charge of the machine department of the Lapointe Machine Tool Company, Hudson, Mass., and A. Deborde, formerly in charge of the tool department of the same concern, have severed their connection with that company, and are now connected in the same capacities with the J. N. Lapointe Company, Marlboro, Mass.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Keyseat and Brace Types of Millers

In Fig. 1 is shown a design of keyseat miller developed by the Newton Machine Tool Works, Philadelphia, Penn., to displace the vertical and horizontal spindle types which they formerly manufactured.

In this machine the diameter of spindle is 2½ inches with a double taper on the end, the largest diameter of which is 4¾ inches. The spindle is arranged to accommodate cutters with a short No. 4 Morse taper and has drift and retaining key slots. The work table is 11 inches wide over the working surface, 16½ inches wide over all. The length of the table over the working surface is 6 ft. 10½ inches and 7 feet 6 inches over all. The minimum distance from the bottom of the spindle to the top of the work table is 6 inches and the maximum distance is 18 inches. The spindle speeds with 425 revolutions to the countershaft range from 1194 to 430 revolutions per minute with the back gears out and from 395 to 142 revolutions per minute with the back gears in. There are 9 changes of gear feed, ranging from 0.115 inch to 10.09 inches per minute. The machine, when belt driven, is furnished with a 4-cone pulley.

The V-blocks furnished are fitted with auxiliary parallels to accommodate the varying diameters and one of the blocks is mounted on a taper base to permit of raising it when operating on shafts having different diameters. In this photograph it will be noted the long helical spiral milling cutter supported at the bottom by an auxiliary support. This provision is made to handle elongated slots in shafting for hoisting machinery and particularly for locomotive piston rods. As an average practice on this machine 13/16 inch diameter keyseats, 4 inches long are milled at the rate of 13/16 inch per minute.

The spindle revolves in bushed bearings, has provision for taking up wear, is driven by a run-about belt either direct or through back gears and the elevation has micrometer measurement. There are provided square lock bearings of the saddle to the upright and adjustments are made by taper shoe. The work table is surrounded by an oil pan; the feed is obtained by means of a screw and revolving nut; the table has square-lock bearings on the base; adjustment is made by taper shoes and the feed is available in either direction. The machine occupies a floor space over all of 8 feet 6 inches by 7 feet. As a standard, this machine is furnished with a table 4 feet in length.

The machine shown in Fig. 2 is a brace miller, recently developed by the same company, having capacity for milling the ends and chamfering one edge of each of two 8x8-inch angles at one time. Where the volume of work permits, two uprights are furnished on a base, permitting the

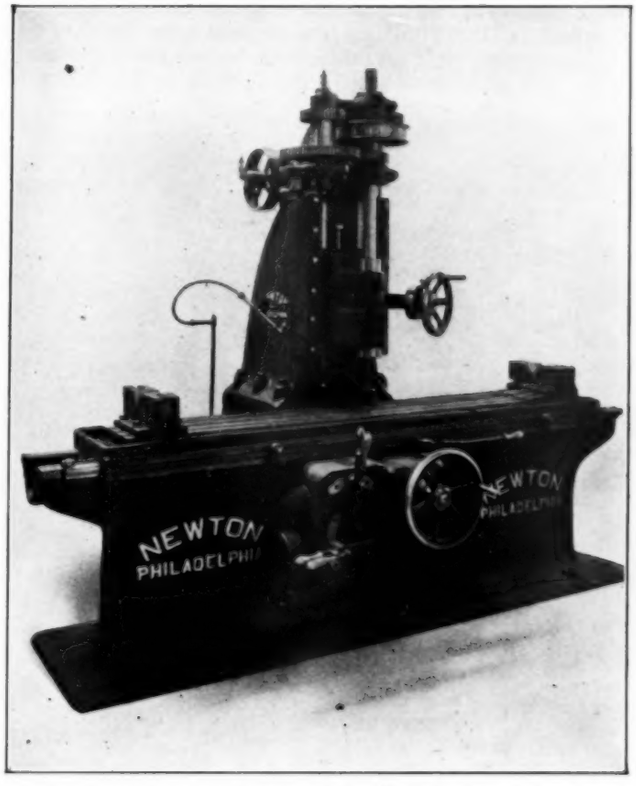


FIG. 1. VERTICAL KEYSEAT MILLER

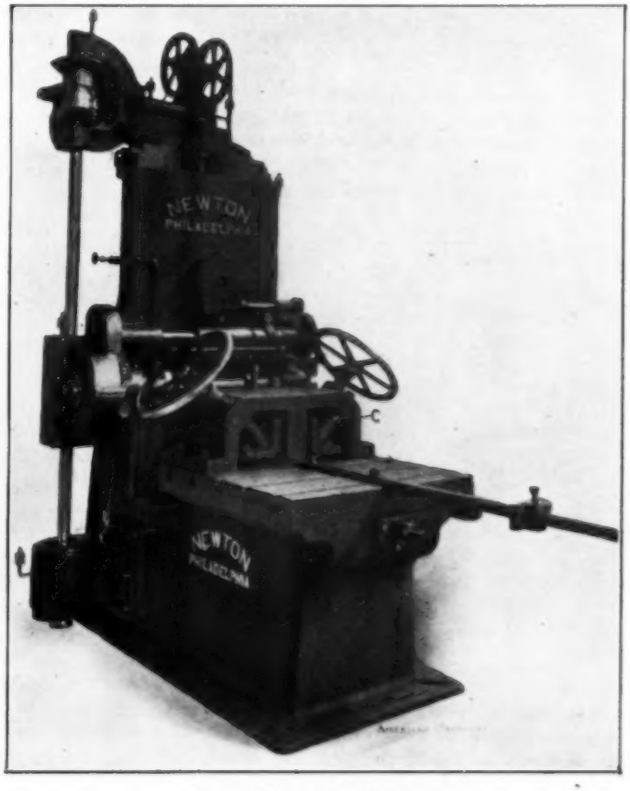


FIG. 2. BRACE MILLER

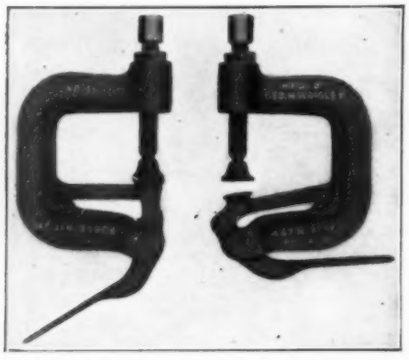
finishing and chamfering of both ends of the stiffeners at one time. Formerly the vise for holding the angles was cast solid with the table, and in the new design the vise is made removable and a separate casting, permitting of the use of the machine for finishing the ends of columns.

The spindle of this machine is 5 inches in diameter, is fitted with a No. 6 Morse taper, arranged to drive the cutter arbor by means of a broad-face key. The arbor is held in place by a through retaining bolt and cutters up to 8 inches in diameter and an individual or combined length of 24 inches can be used. The spindle saddle is fitted to the upright with square-locked bearings, adjustments being made by taper shoe, and the saddle is counterweighted; it has four changes of vertical feed by means of change gears, reversing fast power traverse and hand adjustment. The work table is 39 inches long, 36 inches wide, has 6 inches in and out hand adjustment, and adjustments of the table to the base are made by means of taper shoe.

The drive is by means of a 10-horsepower motor running at 600 to 1200 revolutions per minute. It will be noted that the jaws of the vise are operated independently by handwheels, mounted on the adjusting screw, and special provision is made by the insertion of two circular guides, on which springs are mounted at *C*, to control the parallel position of the jaws when being elevated.

Quick-acting Clamp

The illustration shows a quick-acting clamp made of cast crucible steel, designed for structural and general machine-shop use and made in sizes from 0 to 1½ inches up to 7½ inches. The screw has a lock nut above the head of



QUICK-ACTING CLAMP

the clamp, which can be set for any given size, and will keep the screw set. To apply or release the clamp from the work, it is only necessary to use the lever, which saves considerable time. The head is recessed to allow the button to recede, giving full working capacity of the clamp proper.

This clamp is manufactured by George H. Wrigley, 447 North Sixty-first street, Philadelphia, Penn.

Water Tool Grinder

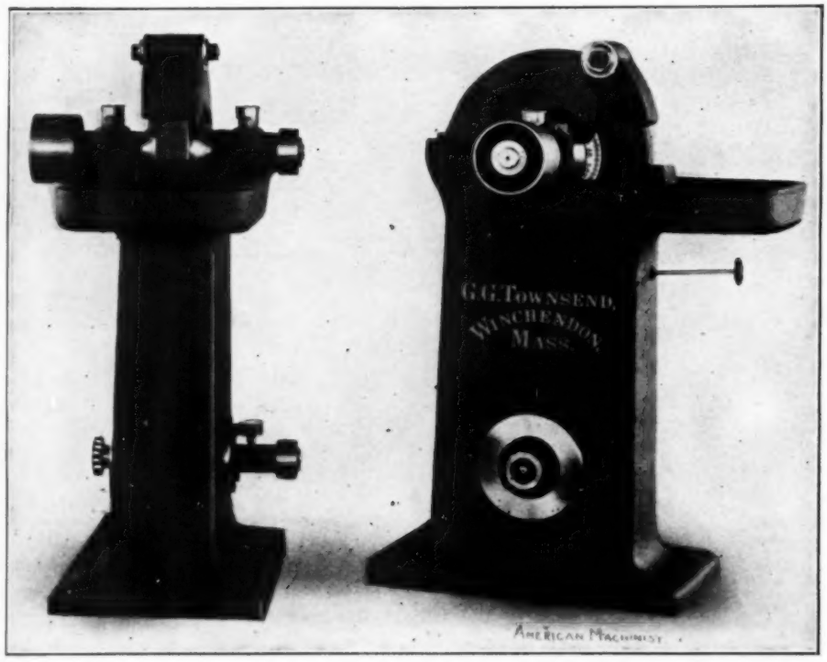
The accompanying halftone shows a wet tool grinder recently developed by Guy G. Townsend, Winchendon, Mass., the design and construction of which are generally apparent.

A MACHINE VISE USED ON A DRILLER AND MILLER

All parts are machined and fitted, and nuts and screws are case-hardened. The shaft is made of crucible steel. The machine is equipped with a pump, and the supply of water is regulated by a valve. The grinding wheel is 16x12 inches, and the machine complete with countershaft weighs about 700 pounds.

A Machine Vise

The halftones show a new machine vise manufactured by Schuchardt & Schütte, West Street building, New York. It has the advantage of great range, as the two members are individual and can be separated as far as the work demands. The individual members consist of a base clamped to the machine platen. On this is mounted a jaw which works in an inclined slide. This jaw is actuated by a double screw, the upper part of which is of large diameter and fits a thread cut in the jaw. The lower part of the screw is smaller than the upper, and is cut the opposite hand to the upper part to give quick action. It works in a nut in the body of the member. The sliding jaws not only clamp the work, but, advancing at an incline, force it down to a seat on the parallels or machine table.



WATER TOOL GRINDER

Quick-acting Jig Clamp and Pipe Vise

In Fig. 1 is shown a quick-acting jig clamp holding work for drilling. The

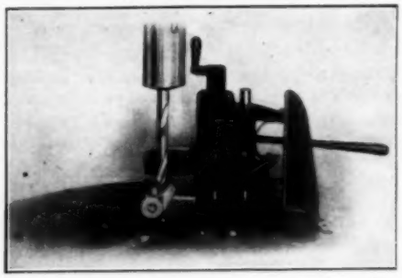


FIG. 1. QUICK-ACTING CLAMP

clamp base is bolted to the bedplate, and pressure on the lever shown securely clamps the piece. The same lever releases the work when lifted.

The clamp is adapted for use in connection with various types of machine tools, such as drillers, grinders, etc.

The body of the tool is made of gray iron, the spindles of steel, and the lever, yoke and adjusting handle of malleable iron. The jaws are made to take wooden dies which can be grooved and doweled to hold any desired form of work.

Fig. 2 illustrates a quick-action pipe wrench especially designed for repetition work, having a capacity for pipe up to 2 inches inside diameter. The pipe jaws or dies are made of special hardened tool steel, and materials used for other parts are similar to those of the clamp described.

The vise is operated by an upward movement of the lever which causes the movable jaw to be thrown back, releasing the work and leaving plenty of clearance for lifting out the work. A downward movement of the lever clamps the

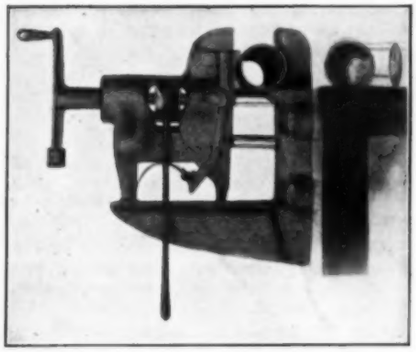


FIG. 2. QUICK-ACTING PIPE VISE

work. Both of the tools shown are recent products of the St. Louis Sales Company, St. Louis, Mo.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

George L. Fairbanks will build a garage on Ashton street, Worcester, Mass.

The Bath (Me.) Iron Works has commenced work on additions to consist of three buildings.

B. W. Decatur has received a permit to build a blacksmith shop at 33 Essex street, Springfield, Mass.

A two-story blacksmith and wagon repair shop will be erected in Easthampton, Mass., by James P. Ryan.

The Dover Stamping and Manufacturing Company, Cambridge, Mass., will erect a new galvanizing factory.

Plans are being prepared for new building to be erected for the New Haven (Conn.) Machine Screw Company. It will be two stories high.

The Union Cutlery and Hardware Company, Union, Conn., manufacture of kitchen cutlery, etc., will move its factory to Springfield, Mass., where it has secured a shop which will be enlarged in the near future.

The Woonsocket Company, Woonsocket, Woonsocket, R. I., has been incorporated to manufacture automobiles, etc. Capital,$5000. Incorporators, Louis V. Hubbard, Upper Montclair, N. J.; R. E. Ballou, Woonsocket, etc.

MIDDLE STATES

Jacob Elwell, Bridgeton, N. J., will build a new automobile garage.

The Youngstown (Ohio) Sashweight Company has commenced erection of plant.

The Standard Aluminum Company, Two Rivers, Wis., will erect a new factory.

A. C. Harrison is having a garage built at 1715 Rittenhouse street, Philadelphia, Penn.

The P. Ernewein Wagon Company, Muskegon, Mich., is erecting a new machine shop.

The Delaware & Hudson Railroad is to build a new roundhouse at Binghamton, N. Y.

W. W. Keefer will build a garage at 4302 Grant boulevard, fourth ward, Pittsburg, Penn.

Extensive additions will be made to the plant of the General Foundry Company, Warren, Ohio.

The American Cash Register Company, Columbus, Ohio, will build a large plant in Detroit, Mich.

W. D. Hedrick is erecting a new blacksmith shop on Chester avenue, near Lincoln, Chester, Penn.

Fire damaged the plant of the Globe Foundry Company, at Port Chester, N. Y., to the extent of $7500.

The Benz Automobile Company, of Derventer, Germany, has secured site for a plant in Detroit, Mich.

The Cleveland Foundry Company, Cleveland, Ohio, will build an addition to its tinplating department.

The Jewell Steel and Malleable Company, Buffalo, N. Y., is erecting a one-story addition to its foundry.

The Columbus Buggy Company, Columbus, Ohio, is in the market for machinery for working sheet metal.

Dixon & Son, manufacturers of blacksmiths' supplies, will build a factory on Liberty avenue, Pittsburg, Penn.

Additional equipment will be purchased by the Carolina, Clinchfield & Ohio Railway for its Erwin City shops.

Plans are being prepared for shop buildings at Rowlesburg, W. Va., for the Baltimore & Ohio Railroad.

Munson Brothers Company, of Utica, N. Y., is considering moving to Whitesboro, N. Y., and erecting a larger foundry.

The Excelsior Supply Company, of Chicago, Ill., builder of the Excelsior motor cycle, is planning additions to its factory.

Fire destroyed the boiler shop of the Anderson Foundry and Machine Company, Anderson, Ind. Will rebuild at once.

The Ferro Machine and Foundry Company, Cleveland, Ohio, will erect an addition to its plant and buy some new equipment.

The Electric Company will remodel its old power plant on Broadway and Mason street, Milwaukee, Wis., into an auto garage.

The Richardson Auto Garage Company, of Detroit, Mich., has been incorporated to do a general garage and repairing business.

A garage to cost $4000 is to be built for L. W. Hicks, on Fifth avenue, near Murray Hill, Fourteenth ward, Pittsburg, Penn.

The Champion Bed Spring Company, Cleveland, Ohio, will erect a $40,000 addition to its factory. J. P. Macbeth is president.

A permit has been issued to D. Howard Ewing for a garage at 2506 Perrysville avenue, Twenty-sixth ward, Pittsburg, Penn.

The American Rotary Valve Company, Anderson, Ind., is in the market for $20,000 worth of new and additional machinery.

The Crane Company has started a five-story addition at 157 North Desplaines street, Chicago, Ill., to be used as a foundry, etc.

The Gordon Propeller Company, Cleveland, Ohio, making ship propellers, has increased its capital and will make additions to its plant.

The Otis Elevator Company will move its Moline plant to Quincy, Ill., at which place an additional $50,000 building will be erected.

Bids will be received August 9 for the construction of an addition to the large gun shop at the Watervliet Arsenal, Watervleit, N. Y.

A permit has been issued to J. C. Trees for a garage on North Highland avenue, near

Highland park, Pittsburg, Penn., to cost $5000.

The Bi-Cal-Ky Fan Company, Buffalo, N. Y., manufacturing blowers and ventilators, is building an addition to its plant on Prospect avenue.

Smith, Hardican Company will build a brick garage at 651 North Broad street, Philadelphia, Penn., for Harry T. Saunders, to cost $2500.

The Akron, Canton & Youngstown railroad has purchased 14 acres at East Akron, Ohio, which will be used for yards. Equipment will be needed.

The American Bridge Company will expend $17,000 on the erection of galvanizing and punch shops at its Fifty-Second street plant, Pittsburg, Penn.

E. C. Geipel has let the contract for a brick garage, 7516-18 Halsted street, Chicago, Ill., and will equip it with tools to repair autos and trucks.

Rudolph Krasburg and Lucilius Moseley have announced their intention of building a factory in Poughkeepsie, N. Y., to manufacture hardware novelties.

The Stevens Manufacturing and Foundry Company, Decatur, Ill., has been incorporated with $75,000 capital by James J. Dietz, Chas. W. Dietz, Willard Rowe.

The Baltimore & Ohio Railroad will reopen its car shops at Sandusky, Ohio, and will give employment to about 600 men. Shops have been closed over ten years.

The Nelson Brothers Company, of Alma, Mich., manufacturer of gasolene engines, will move its plant to Saginaw, Mich., and is planning greatly increased output.

The Korff Manufacturing Company, Lansing, Mich., making metal specialties, is erecting an addition to its plant to be used as oxidizing and plating department.

The Remy Electric Company, of Anderson, Ind., manufacturer of ignition and lighting magneto devices, is erecting an addition to its plant and will need equipment.

A permit has been issued to Harry B. Shoemaker to build two garages on the north and south side of Clivedon avenue, east of Wissahickon avenue, Philadelphia, Penn.

The National Motor Truck Company, Bay City, Mich., recently organized, has acquired site for plant, which will include main building, machine shop, motor-test shop.

The Appollo (Penn.) Sheet and Tin Plate Company will erect a large plant; also new mills at Kitanning and Leechburg, Penn., to be operated by subsidiary companies.

The Foundry Economy, of Port Chester, N. Y., has been incorporated with $6000 capital. William A. Mills, of Port Chester, and J. H. Mueller, of New York, are directors.

C. G. Everson & Co., Chicago, Ill., has been organized to manufacture gas and electric fixtures by Roy B. Everson, Herman V. Willman, Carl G. Everson. Capital, $40,000.

The Crucible Steel Company, Harrison, N. J., is to erect two additional buildings to its plant. One of the buildings will be used as a press department, the other by the treating department.

The Atlantic Perfected Motor Company, Atlantic City, N. J., has been incorporated to manufacture motors, engines, etc. Capital, $250,000. Incorporators, F. Brown, T. Kilcourse, S. S. Phoebus.

The Abbott-Detroit Sales Company, Cleveland, Ohio, has been incorporated to operate a sales agency and garage. Incorporators, O. D. Eshelman, R. E. Deacon, R. E. McClellan, etc. Capital, $20,000.

The Fire Retainer Heater Company, of Columbus, Ohio, has been incorporated with a capital of $500,000 to erect a plant to manufacture a patented heater. It is proposed to locate the plant in Columbus.

The Hess-Bright Manufacturing Company, Philadelphia, Penn., manufacturer of ball bearings, etc., has purchased a site at Erie avenue and Broad street, Philadelphia, on which it will build a new plant.

The Schmitt Manufacturing Company, North Bergen, N. J., has been incorporated to manufacture gas stoves, engines, etc. Capital, $100,000. Incorporators, R. J. Lynch, Christopher Schmitt, John Schmitt.

The Barry Automatic Specialty Company, Chicago, Ill., has been organized to manufacture automatic slicing machinery and specialties by Henry Barry, Chas. G. Boughner, Wm. A. Jennings. Capital, $10,000.

The Imperial Brass Manufacturing Company, 524-32 South Center street, Chicago, Ill., has broken ground for a six-story factory that will cost over $100,000. It will more than double the present output.

Work has been commenced on a new plant for the Continental Motor Manufacturing Company, on Jefferson avenue, Detroit, Mich. Gasolene motors will be manufactured. The concern now has a plant at Muskegon.

MacDonald & Sons Manufacturing Company, Buffalo, N. Y., has been incorporated to manufacture machinery and tools. Capital, $100,000. Incorporators, P. E. MacDonald, Toronto; H. J. Word, W. A. Hyle, Buffalo.

The Barrett Motor Car Company, Buffalo, N. Y., has been incorporated to manufacture motor cycles, vehicles, etc. Capital, $10,000. Incorporators, Frank Barrett, 1450 Delaware avenue; Ed. J. Meyer, 1312 Main street, etc.

The Loupin Iron Works, Brooklyn, N. Y., has been incorporated to manufacture structural iron work. Capital, $10,000. Incorporators, Isaac Rosen, 605 Broadway, New York; Isidor Solomon, 486 Halsey street, Brooklyn, etc.

The Hexter Motor Truck Company, New York, has been incorporated with $10,000 capital to manufacture motor trucks, cars, etc. Incorporators, A. A. Alexander, A. T. Rook, Maurice Milimet, all of 51 Chambers street, New York.

Brown, Jennings & Lauter, Newark, N. J., have incorporated to manufacture jewelry and novelties. Capital, $100,000. Incorporators, Jas. A. Brown, 338 Belmont avenue, Newark, Chas. P. Jennings, 8 Fourth street, Union Course, L. I., etc.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids August 22 for one cutting-off machine for the Boston navy yard as per schedule 3806, and one cutting-off saw for the Philadelphia navy yard as per Schedule 3805.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids September 5 for one sensitive drill, one emery grinder, one gap lathe, one tool room lathe, one shaping machine, one arbor press, one drill press, for the Mare Island, Cal., navy yard, as per Schedule 3803.

SOUTHERN STATES

The Southern Manufacturing Company will build a new can factory adjoining its present one in South Richmond, Va.

Plans are being prepared for a large machine shop for the Page Engineering Company, on Claggett street, Baltimore, Md.

WEST OF THE MISSISSIPPI

John Landis, of Neligh, Neb., will erect a blacksmith shop.

Joseph McCarty, of Williamsburg, Iowa, will erect a blacksmith shop.

The blacksmith shop of W. A. Steinbaugh, Alhambra, Cal., was destroyed by fire.

Clark & Kellogg, of Charles City, Iowa, are considering the erection of an engine factory.

The Hart-Parr Company, Charles City, Iowa, contemplates adding a foundry to its plant.

The machine shop of the Duncan Granite quarry, near Porterville, Cal., was destroyed by fire.

The Texas Central Railroad will install new machine shops at Cisco and make other improvements.

The Bridger (Mont.) Coal and Improvement Company will erect a 35x100-foot machine shop.

The Northwestern & Omaha Railroad Company is building a 15-stall roundhouse at Omaha, Neb.

H. E. Bothin, Fresno, Cal., is having plans prepared for a commercial garage and automobile machine shop.

Fire destroyed the foundry of the Fisher Machine Works, Leavenworth, Kan., causing a loss of about $20,000.

The D. & B. Pump and Supply Company, Los Angeles, Cal., has taken out a permit to build a new machine shop.

The Ludlow-Saylor Wire Company will erect a four-story machine shop at 634 South Newstead avenue, St. Louis, Mo.

The Southern Pacific Railroad will increase the capacity of its roundhouse at Los Angeles, Cal. D. T. Rintoul is engineer.

The Reliance Foundry Company, Los Angeles, Cal., has taken out a permit to make additions and improvements in its plant.

The Holly Sugar Company, Huntington Beach, Cal., will build a large garage for the care and repair of its business automobiles.

The Kelso Brothers, Main street, Los Angeles, Cal., have taken out a permit to erect a large commercial garage and automobile machine shop.

T. D. Blodgett, Redondo Beach, Cal., has taken out a permit to erect a commercial garage and repair shop. Modern machinery will be installed.

The Pacific Hardware and Steel Company, Ore., is planning for the erection of a new iron and steel rolling mill plant. A. C. Callen is manager at Portland.

The S. B. Hicks Wire Rope Company, Seattle, Wash., will build a plant for the manufacture of its product at Kent, Wash. About $250,000 will be expended.

A manual training addition will be erected at the Lincoln school, Everett, Wash. Estimated cost, $35,000. Architect B. F. Turnbull, Everett, is preparing plans.

A manual arts building will be erected for the Ontario (Cal.) high school. Modern equipment will be installed by the school board. John C. Austin, architect, Los Angeles.

The Union Machinery and Supply Company, Seattle, Wash., contemplates an addition to its plant. A new foundry building will also be erected. S. M. Prescott is manager.

The Boenker Motor Plow Company, St. Charles, Mo., has been incorporated to manufacture motor plows. Capital, $24,000. Incorporators, H. H. Boenker, Louis Ringe, H. Geo. Barklage, etc.

The Good Roads Company, Inc., has been incorporated with offices at Santa Fe, N. M., by M. B. and Nat Tyler, Jr., Short Hills, N. J., with a capital of $25,000. The company will manufacture road machinery.

Harry Henderson, Artesia, Cal., will build a plant for the manufacture of a patented garden plow. Modern machinery will be installed. The present building will be added to, by the group system, in the near future.

CANADA

The Central Garage, Winnipeg, Man., was entirely destroyed by fire.

The Central Pacific Railroad will build new brass shops at Montreal.

J. Porteous will equip a new garage and repair shops at 551 York street, Hamilton.

The Dominion Nut and Bolt Fastener Company will locate a big new plant in Montreal.

A big new garage and repair shops will be equipped at Jarvin and Charles streets, Toronto.

A new roundhouse and shops will be built by the Grand Trunk Pacific, at Grand Falls, New Brunswick.

The Canada Car Company, of Montreal, will build a big addition to its branch plant at Amherst, Nova Scotia.

General Manufacturing

NEW ENGLAND

Greenfield, Mass., will extend its water system.

Belchertown, Mass., contemplates increasing its water supply.

Cummington, Mass., contemplates increasing its water supply.

The Russell & Erwin Company, New Britain, Conn., will build a pump house.

Hastings, Mich., voted $120,000 bonds for municipal hydroelectric plant.

The Mayo Woolen Mill Company, Millbury, Mass., will install a new engine.

Holyoke, Mass., will install a tank pumping station at the tuberculosis hospital.

Improvements will be made to the plant of the Columbus (Ohio) Ice Company.

The Bradley Polytechnic Institute, Peoria, Ill., will erect a $25,000 power house.

Riverside Laundry, Concord Junction, Mass., was destroyed by fire. Loss, $15,000.

The Smith Paper Company, Lee, Mass., will install new power-house equipment.

The Electric Light Company, at Huntington, Mass., is considering installing a waterwheel.

North Adams, Mass., has under consideration a municipal gas and electric-lighting plant.

The Belmont Laundry, Belmont avenue, Springfield, Mass., will erect an addition to its plant.

The Globe-Wernicke Company, Cincinnati, Ohio, will build a large addition to its Norwood plant.

Carl Wurtzback and Alexander G. Uptegraff, of Lee, Mass., contemplate increasing the Lee electric power plant.

The New England Cotton Waste Company, Boston, Mass., has awarded contract for the erection of a new factory.

The Comstock Cheney Company, Ivoryton, Conn., makers of ivory goods, has awarded contract for an addition to its factory.

The Worcester Suburban Electric Company will erect a power plant at Millbury, Mass., same to be fitted with transformers, etc.

Contract has been awarded for the erection of an addition to the boiler house of Pratt, Read & Co., at Deep River, Conn.

The C. R. I. & P. RR. will build a new power house at Wentworth avenue and Forty-Seventh street, Chicago, Ill., at a cost of over $30,000.

New pottery machinery will be required for large additions being made to the Ransbottom Brothers Pottery Company, at Roseville, Ohio.

The Eastern Novelty and Lighting Company will open a factory in Westfield, Mass., to manufacture a patented gas lamp and other articles.

The Revere Bath House and Amusement Company, Revere, Mass., will build a swimming pool and will require boilers, pumps, heaters and filters.

Proposals will be received until 2 p.m., Aug. 16, for the installation of a new pump at Madison Barracks, N. Y. Specifications can be had of the quartermaster.

Henry Christman & Sons, piano manufacturers, of 597 East One Hundred and Thirty-Seventh street, New York, are reported to be considering the establishment of a plant in Newburgh, N. Y.

The Plainville Paper Box Company, Plainville, Conn., has incorporated with $10,000 capital to manufacture paper boxes. Incorporators, Charles E. Young, F. S. Fletcher and J. F. Lyons.

The Killingly Manufacturing Company, Killingly, Conn., has incorporated with $500,000 capital to manufacture cotton goods. The Williamsville mill, at Killingly, has been purchased and will be greatly enlarged.

The Cummings Shoe Company, Worcester, Mass., has organized with a capital of $60,000 to manufacture shoes. T. Frank Hallett, Boston, Mass., president; Merton W. Clement, Worcester, Mass., treasurer and manager.

MIDDLE STATES

The Bridgeton Water Company will build a new pumping plant.

A municipal waterworks system will be established at Tarentum, Penn.

The Riley Shoe Company, Columbus, Ohio, will erect a new shoe factory.

The Perkins Glue Company, of Landsdale, Penn., is going to enlarge its plant.

The Wiedmann Silk Dyeing Company, Paterson, N. J., will erect two additions.

Utica (N. Y.) Knitting Company will build a brick addition to its Erie Street mill.

An engine house will be built for the Reading Railway Company, at St. Clair, Penn.

The Detroit, Mich., public lighting commission is erecting an addition to its plant.

The plant of the McGraw Plaster Company, of Detroit, Mich., was partially destroyed by fire.

The Birdsboro Gas Company, of Schuylkill Valley, Penn., will build an uptodate gas plant.

The Steubenville (Ohio) Ice Company will erect an addition, doubling its present capacity.

The Stewart Hartshorne Company, East Newark, N. J., will erect an addition to its factory.

The borough of Etna, Penn., has let the contract for the building of its new pumping station.

The Elkhart & Becker Brewing Company, Detroit, Mich., will erect a large addition to its plant.

The Commercial Milling Company, flour millers, Detroit, Mich., is erecting an addition to its plant.

The plant of the American Butter and Cheese Company, Cleveland, Ohio, was destroyed by fire.

The plant of the Kneeland Bigelow Lumber Company, Bay City, Mich., was partially destroyed by fire.

The Franklin Manufacturing Company will establish a magnesia plant in Stoneboro, Mercur county, Penn.

The boiler room of the Wisconsin Iron and Wire Works, at Milwaukee, Wis., was damaged by fire. Loss, $15,000.

The Freeport (Ill.) Shoe Manufacturing Company is to rebuild its plant destroyed by fire several months ago.

The Bingham Manufacturing Company, Cleveland, Ohio, will build a factory for the manufacture of carburetors.

The Banner Brewing Company, Saginaw, Mich., will erect an addition to its present plant and boiler house also.

The power plant of the Pressed Steel Wheel Company, in Stowe township, Pittsburg, Penn., was destroyed by fire.

At Dayton, Ohio, a paper mill is to be erected by the Aetna Paper Company. The plant will be two stories high.

An addition to cost $5000 will be built to the packing plant of J. M. Denhold Bros. & Co., East End, Pittsburg, Penn.

The Perfection Steam Laundry Company, Springfield, Ohio, will require some new machinery. Joseph Levy, manager.

Fire destroyed the flour mills near Clinton, Miss., owned by the Bulte Milling Company, of Kansas City, Mo. Loss, $200,000.

The Gordon-Pagel Baking Company, of Detroit, Mich., is erecting a large addition to its plant and will need new equipment.

The United States Glass Company will make alterations and additions to its plant on South Ninth street, Pittsburg, Penn.

The Eagle Ice and Coal Company, Philadelphia, Penn., will erect a new plant on the West Chester Railroad at Fifty-Sixth street.

The Berg Distilling Company of Philadelphia, Penn., has bought a site for a new modern plant at Morris and Swanson streets.

A. E. Appleyard and F. D. Sullivan, of Ashland, Wis., are considering the erection of a small power plant on the Bad river, at Mellen, Wis.

The plant and machinery of the Pennsylvania Ice Company, at Walnut and Center streets, Wilkinsburg, Penn., were destroyed by fire. Loss, $50,000.

The Press, Cleveland, Ohio, will soon start to erect a modern newspaper plant. Will require various mechanical equipment, together with some machine-shop tools.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids August 22 for one 12-horsepower gasolene engine as per Schedule 3807.

The West Side Milling Company, Masillon, Ohio, was incorporated by Jacob Myers and others to do a general grain business. May require some new machinery soon.

The machine room at the plant of the Allegheny Brick Company, at Valley Camp, Penn., on the Allegheny Valley Railroad, was destroyed by fire. Damage, $10,000.

The Glenville Laundry Company, Cleveland, Ohio, was incorporated by J. Harper, J. E. Weaver, C. E. Nauman and others. Will equip a modern steam-laundry plant.

Hamilton Brewery Company, Hamilton, Ohio, has been organized with $100,000 capital to operate a brewery by Max Herman, Louis F. Marner, Philip Beiser, etc.

The D. L. Clark Company, candy manufacturer, of McKeesport, Penn., has purchased a factory on Martin street, Pittsburg, Penn., and will make extensive alterations.

Rea & Co., Pittsburg, Penn., pork packers, are rebuilding the refrigerating plant and packing department at Second avenue and Try street, recently destroyed by fire.

The Republic Rubber Company, Youngstown, Ohio, will build additions to its plant that will double the capacity. A complete low-pressure turbine system will be installed.

The Eureka Chemical and Manufacturing Company has purchased a site at Penn and Brushton avenues, Pittsburg, Penn., and will erect a plant for the manufacture of asphalt products.

The Camden Ice Company, Camden, N. J., has been incorporated to manufacture ice. Incorporators, C. R. Sigle, 14 North Thirty-Fourth street; Geo. H. Burris, 3405 Howell street, etc.

The Swinehart Tire Rubber Company, Akron, Ohio, has increased its capital to $800,000. The firm will build several additions and new buildings to increase its manufacturing facilities.

The Zemmer Company, manufacturer of physicians' supplies, has purchased a site on Louisa street, opposite Forbes Field, Pittsburg, Penn., and will erect a four-story factory to cost $50,000.

The Jackson Water Supply Company, Jackson, Ohio, has been organized to build and operate a waterworks system by J. M. McGillvray, James McVicker, Emmett Dungan, etc. Capital, $150,000.

The Frederick J. Lau Company, Newark, N. J., has been incorporated to manufacture traveling-bag frames, trimmings, locks, etc. Capital, $10,00. Invcorporators, F. J. Lau, Michael Lau, Geo. A. Pfeffer.

The Cleveland Multiphone Company, Cleveland, Ohio, has been incorporated with a capital of $10,000 to manufacture phonographs and multiphones. Incorporators, Erwin G. Guthery, B. J. Guthery, G. E. Mann, etc.

The United States Cold Storage Company will erect a plant in Milwaukee. Will have storage space of 1,100,000 feet; also power house and ice plant of 72 tons daily capacity. John Ahlschlaeger & Sons, Chicago, architects.

The Saxon Manufacturing Company, Toledo, Ohio, has been organized with $10,000 capital to manufacture and sell lamps and all kinds of automobile accessories by Herman Saxon, Charles G. Cunningham, Richard D. Logan, etc.

The Twentieth Century Storm Buggy Company, St. Henry, Mercer county, Ohio, has been organized to manufacture all kinds of buggies, carriages and horse-drawn vehicles b Henry Wimmers, J. A. Schrach, Joseph J. Moeller, etc. Capital, $20,000.

The Napoleon Gas Company, Napoleon, Ohio, has been incorporated to erect a plant for the manufacture of artificial gas for heating and illuminating purposes. Incorporators, William T. Morris, Joseph A. Sloan, Bernard Sloan, etc. Capital, $25,000.

Bids will be received at the office of the Director of Public Service, 104 City Hall, Cleveland, Ohio, until August 14, 1911, for furnishing transformers for the municipal electric-light plant. Specifications may be obtained of the superintendent of the water department.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids August 15, for 14 forced draft blowers (schedule 3800), dynamo, combination desk and bracket fans (schedule 3816), 16 worm-geared chain blocks (schedule 3818), 15 portable blacksmith forges (schedule 3814).

SOUTHERN STATES

The American Net and Twine Company, Birmingham, Ala., will enlarge its plant.

The F. A. Torsch Packing Company, Baltimore, Md., will erect a two-story addition.

Six turbine-driven generators will be purchased by the Birmingham (Ala.) Water, Light and Power Company.

WEST OF THE MISSISSIPPI

The city of Dorris, Cal., will install a waterworks system.

It has been voted to install a waterworks system at Prairieburg, Iowa.

The Porterville (Cal.) Northeastern Railroad will build a new power plant.

The city of Vallejo, Cal., contemplates the erection of a municipal lighting plant.

Bonds for $3000 have been voted for a waterworks system at Courtland, Minn.

The Cameron-Folts Company, Odell, Ore., will build a new box-manufacturing plant.

The Northern Cold Storage Company, at Duluth, Minn., will erect a $43,000 addition.

The Crystal Ice Company's plant at Pierre, S. D., was destroyed by fire. Loss, $20,000.

A vote will be taken on August 7 for a franchise to erect a gas plant at Carroll, Iowa.

M. P. Ryan will erect a $7,500 laundry at West Seventh and Chestnut streets, St. Paul, Minn.

The city of Hemet, Cal., is planning for the installation of a waterworks and pumping plant.

The city of Bakersfield, Cal., plans to install a new waterworks system at East Bakersfield.

The city of Levan, near Nephi City, Utah, contemplates the installation of a waterworks system.

The city of Burlington, in the Tualatin Valley, Ore., will install an electric-lighting system.

The Moorpark (Cal.) *Star* will build a new printing plant. Modern equipment will be installed.

The Iowa Canning Company, of La Porte, Iowa, will make extensive improvements to its plant.

An electric plant will be installed at Glen Ullin, N. D. C. E. V. Draper, engineer, Mandan, N. D.

The plant of the Hartson-Otis Lumber Company, Tenino, Wash., was destroyed by fire. Loss, $20,000.

The sawmill of the Frost-Cope Lumber Company, Wrencoe, Ida., was destroyed by fire. Loss, $15,000.

The Chehalis River Lumber and Shingle Company, Centralia, Wash., will build a new sawmill plant.

The Citizens' Committee, Winters, Cal., is planning to install an electric-lighting system at Winters Lake.

The Clovis (Cal.) Farmers' Union will build a new fruit-packing plant. Modern machinery will be installed.

The Midway View Oil Company, Olinda, near Whittier, Cal., will install new rotary drilling equipment.

The American Concrete Pile Pipe Company, of Des Moines, Iowa, is planning the erection of a factory there.

A rate will be taken August 14 on issuing $11,000 in bonds for an electric-light system at Pochahontas, Iowa.

The council at Webster City, Iowa, appropriated $10,000 for the municipal electric-light and power building.

The Iten Cracker Company, of Clinton, Iowa, and Omaha, Neb., is to build a $150,000 factory in Oklahoma City.

W. D. Murray and Edward Lyne, Silver City, N. M., are planning to install new pumping plants near Deming, N. M.

The Idaho Realty, Power and Mines Company, near Dixie, Ida., is planning for the erection of a new power plant.

The Christenson Lumber Company, San Francisco, Cal., has taken out a permit to build an addition to its plant.

Ramon Mungia, Magdalena, N. M., will increase the capacity of his flour-milling plant. New machinery will be installed.

The Home Telephone Company, San Francisco, Cal., contemplates the installation of a plant and system at Reno, Nev.

The San Diego (Cal.) Southern Railroad contemplates the installation of a new pumping plant near Rock Springs, Cal.

The Ambrosia Chocolate Company, Milwaukee, Wis., will erect a six-story addition to its plant at 331-337 Fifth street.

Fire destroyed the milling plant and several elevators of the Bay State Milling Company, Winona, Minn. Loss, $300,000.

The Cudahy Packing Company is making additions to its cold-storage plant at Fourteenth and Jones streets, Omaha, Neb.

The city of Gladstone, Ore., will install a new pumping plant and waterworks system. L. C. Kelsey, Portland, Ore., is engineer.

The city of Eugene, Ore., has carried its bond issue of $57,000 for improvements and extensions in the municipal electric plant.

The city of Nogales, Ariz., plans for the installation of a waterworks and sewerage system. Bonds for $160,000 will be voted.

The Italian-Swiss Colony, San Francisco, Cal., is planning for the erection of a new bottling plant. Estimated cost, $100,000.

The Danish Creamery, Fresno, Cal., has taken out a permit to erect a new creamery plant. Modern equipment will be installed.

The Pacific Power and Light Company, Portland, Ore., contemplates the installation of an electric-lighting system at Adams, Ore.

The Pacific States Telephone and Telegraph Company, San Francisco, Cal., contemplates the erection of a new plant at Riverbank, Cal.

J. M. Westerfield, Banning, Cal., is at the head of a company which plans for the erection of a large fruit-canning plant near the city.

The Walker Lumber Company (Clinton Walker), Red Bluff, Cal., contemplates the erection of a large lumber-mill plant in this section.

The Thompson Furniture Company, of Duluth, will erect a $10,000 factory at Hurd street and Commonwealth avenue, New Duluth.

The sawmill of the Garrow Lumber Company, Corvallis, Ore., was destroyed by fire. Loss, $30,000. It is said that the plant will be rebuilt.

The Seattle (Wash.) School Board will build a new boiler-house addition to the Lin-

coln high school. Edgar Blair, school architect, Seattle.

The St. Gothard Gold Mining Company, Grass Valley, Cal., operating the Delhi mine, is planning for the erection of an electric power plant.

The Portland (Ore.) Flouring Mills contemplates the erection of a new milling plant at Seattle, Wash. T. B. Wilcox is president of this company.

The Fletcher Tire Company, Portland, Ore., will build a plant for the manufacture of a puncture-proof automobile tire. The plant will be fully equipped.

The Desert Power and Water Company, Kingman, Ariz., will increase the capacity of its power plant. W. A. Richardson is secretary of this company.

The Pacific Portland Cement Company, Vallejo, Cal., is planning for extensions in its electric power, light and heating system. A franchise has been asked.

The Northern Arizona Gas Company, Kingman, Ariz., is planning for the erection of a new gas plant. The company has headquarters at Los Angeles, Cal.

A complete laboratory equipment, including crushers, grinders and mining machinery, will be installed by the Young Men's Christian Association, Los Angeles, Cal.

The Colusa County Telephone Company, Colusa, Cal., will make extensive improvements and additions to its plant and system. New equipment will be installed.

A large dairy plant will be erected at the Oregon Agricultural College, Corvallis, Ore. Modern machinery will be installed. Bennes & Hendricks, architects, Portand.

The power plant of the Portland (Ore.) Railway, Light and Power Company, at Vancouver, Wash., recently destroyed by fire, will be rebuilt. Estimated cost, $65,000.

The Sacramento Valley Power Company, San Francisco, Cal., will increase the capacity of its two 2000-horsepower power plants, near Lassen Peak, to 7000 horsepower each.

The Northern Water and Power Company, Grass Valley, Cal., is planning for the erection of three power plants of 175,000 horsepower total capacity on the Yuba river.

The C. W. Merritt Sawmill, Twisp, Wash., has been acquired by C. H. Manning and W. H. Scott. A planing mill addition will be erected and modern machinery installed.

The Southern California Gas Company, Los Angeles, Cal., has acquired a site at Colton, and plans for the erection of a large gas plant. Estimated expenditure, $750,000.

Bucket elevators, conveyers, mixers, grinding machinery, etc., will be installed in the new plant of the General Fertilizer Company, San Bernardino, Cal. Bids will soon be asked.

The Ghiradelli Company, San Francisco, Cal., candy manufacturer, is having plans prepared for a new plant. Modern equipment will be installed. About $125,000 will be expended.

The West Highland Citrus Association, Highland, Cal., is having plans prepared for a new fruit-packing plant to replace that destroyed by fire. Modern equipment will be installed.

The Ideal Window Screen Company, Tacoma, Wash., has broken ground for a large manufacturing plant for its specialty. The factory will be fully equipped with the most modern machinery.

The Superior Land and Water Company, Elsinore, Cal., will abolish its crude-oil burning plant and install the necessary machinery for electric operation. C. E. Waite is president of this company.

The Sherman Institute, Sherman, near Los Angeles, Cal., a Government institution, will build a new shop building for carpenter work and other trades. Superintendent Conser is interested in this work.

The Pacific Telephone and Telegraph Company, San Francisco, Cal., contemplates the erection of a large exchange and office building, about 10 stories, at Portland. The plant will be thoroughly equipped.

Power-plant equipment will be installed in the new office and theatre building to be erected by W. M. Garland, Los Angeles, Cal., Estimated cost, $600,000. Morgan, Walls & Morgan, architects, Los Angeles.

Power-plant equipment will be installed in the new Fraternal Home to be erected by the California Odd Fellows Home Association, Santa Clara, Cal. Estimated cost, $150,000. R. W. Hart, architect, Santa Clara.

The Benson Lumber and Mill Company, San Diego, Cal., contemplates the erection of a new mill and plant at San Pedro (Los Angeles), Cal., removing its present plant to this location and increasing the capacity.

The Valley Improvement Company, Portland, Ore., is planning for the erection of a large power plant near Randall, Wash. It is said that about $15,000,000 will be expended upon plant and transmission system.

The Pacific Lumber and Manufacturing Company, Portland, Ore., contemplates the erection of a large addition to its plant to be equipped for hardwood work. J. S. Emerson is the head of this branch of the company.

The Santa Ana (Cal.) Coöperative Sugar Company will build a large beet-sugar plant of 600 tons per day capacity. About $500,000 will be expended. The Dyer Company, Cincinnati, has a contract for the buildings.

Power-plant equipment will be required in the new 10-story office building to be erected by the M. H. Walker Realty Company, Salt Lake City, Utah. This company is capitalized at $1,000,000; Matthew H. Walker is president.

The American Industrial Corporation (Gustavus Heyman, treasurer), San Francisco, Cal., has acquired property at Tampico, Mex., and is planning for the erection of an ice and cold-storage plant, a brewery and packing plant.

Power-plant and generating equipment will be installed in the new hotel to be erected by the Hood River (Ore.) Mineral Springs Company. About $100,000 will be expended. Goodrich & Goodrich, architects, Portland, Oregon.

The Birdseye Marble Company, Salt Lake City, Utah, recently organized, will install a complete equipment of marble-working machinery at its property near Thistle Junction, Utah. George Romney is president of this company.

The Consolidated Telephone, Telegraph and Electric Company, Tucson, Ariz., will make additions in its plant and install new equipment. The entire system to Pima will be rebuilt. C. W. Hinchcliff is manager of this company.

Six large pumping and heating plants combined, will be installed by the Guaranty Pipe Line Company, Los Angeles, Cal., in connection with its pipe line, for oil, from Midway to this city. Estimated cost of plants, $150,000.

Laundry and boiler equipment, a vacuum cleaning and refrigerating plant will be installed in the new apartment hotel to be erected by A. L. Hill, Los Angeles, Cal. Estimated cost, $140,000. J. W. Chalmers, architect, Los Angeles.

The Horton Portable House Company, Wilmington (Los Angeles), Cal., has acquired property in the Millside tract and will build a large woodworking plant for the manufacture of portable bungalows. J. D. Horton is president of this company.

The Sacramento (Cal.) Ramie and Textile Company, recently organized with a capital of $50,000, will build a large textile-manufacturing plant in this vicinity. Modern machinery will be installed. Clinton L. White, Sacramento, is interested in this company.

CANADA

Toronto will spend $300,000 on waterworks extensions.

Wilkie, Sask., will equip a complete new pumping plant.

Sudbury, Ont., will make important extensions to its waterworks system.

Ottawa will buy a large quantity of new waterworks pumping machinery.

The McLelan Lumber Company will equip a big new sawmill at Ladner, B. C.

The American Cyanide Company, Niagara Falls, Ont., is erecting a $10,000 addition.

Quebec City, Que., will spend $750,000 on waterworks extensions and new equipment.

The Chipman-Holten Knitting Company, Hamilton, Ont., is erecting a new dyehouse.

Chilliwack, B. C., will equip a big municipal pipe-making plant for manufacturing sewer pipe.

Wilkie, Sask., will buy complete new machinery for an electric-light and power system.

The Evans Syndicate will build a new street railway and power plant at Saskatoon, Saskatchewan.

Palmer Bros. & Henning, Vancouver, B. C., railway contractors, are in the market for axles, wheels and steel rails for a recent contract.

Important extensions requiring large quantities of new equipment are being made to the Quebec & Saguenay Railway. Head office, Quebec.

The city of Kamloops, B. C., is planning for the erection of a 500-horsepower generating plant on the Barrier river. About $200,000 will be expended.

MINING

George M. Smith, Stanley, Ida., is planning for the erection of a reduction plant.

The Butte (Mont.) & Superior Company will build a large zinc-concentrating plant.

The Massoletti mine, near Benson, Ariz., contemplates the erection of a milling plant.

The Gray Lease, near Goldfield, Nev., contemplates the erection of a 50-ton reduction plant.

The Rawhide mine, near Towles, Cal., is planning for the erection of a new milling plant.

The Nelly Bly mine, near Virginia City, Mont., plans for the erection of a milling plant.

The San Juan de Taviche mine, near Oaxaca, Mex., plans for the erection of a 200-ton milling plant.

The Homestake mine, Black Hills district, South Dakota, contemplates the erection of a new stamp mill.

The LaNumex Mining Company, Hachita, N. M., is planning for the erection of a concentrating plant.

The Porcupine Gold Mines Company, Ontario, Can., is in the market for new machinery and equipment.

The Transvaal Mining Company, Cumpus, Sonora, Mex., is planning to build a new concentrating plant.

The Columbia Mining Company, near Keystone, S. D., contemplates the erection of a mill and cyanide plant.

The Palmarejo Goldfields, Ltd., Chinipas, Chihuahua, Mex., is planning for the erection of a 300-ton milling plant.

The Austin (Nev.) Manhattan Consolidated Mining Company is planning to increase the capacity of its milling plant.

The Buffalo-Arizona mine, near Hot Springs Junction, Ariz., is planning for the erection of a 100-ton smelting plant.

The Cripple Creek (Colo.) Mohawk Mining Company is said to be planning for the erection of a large milling plant.

The Butte & Superior Company, of Butte, Mont., will erect a zinc-concentrator plant. First unit will have a capacity of 50 tons.

The Burlington mine, near Forbestown, Cal., will soon commence the erection of a 100-ton mill; the capacity will be increased to 300 tons in the near future.

The El Chanate Mining and Milling Company, Altar mining district, Sonora, Mex., will install a new milling plant. The company maintains offices at Los Angeles, Cal.

Business Item

The Welles Caliper Company, Milwaukee, Wis., has taken over the business of F. A. Welles, Waukeska, Wis. A. J. Machek has become general manager of the new concern.

Trade Catalogs

Standard Roller Bearing Company, Philadelphia, Penn. Bulletin No. 25. Grooved ball end-thrust bearings. Illustrated, 22 pages, 7½x10 inches.

The Fred J. Swaine Manufacturing Company, St. Louis, Mo. Catalog. Presses, dies, sheet-metal tools. Illustrated, 200 pages, 6x9 inches.

Forthcoming Meetings

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Welles tools. Welles Caliper Co., Milwaukee, Wis.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Specialties to manufacture; uptodate brass foundry and machine shop; automatic machinery, etc. Edward Schroeder Lamp Works, Jersey City, N. J.

Wanted—Novelties for butchers; wanted butchers' saw filing machines. Full particulars, J. Field & Sons, Barker's Road, Kew, Victoria, Australia.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Competent mechanical engineer, N. Y. City, designs special and automatic machines and tools for all kinds of duplicate work; highest references. Box 852, AMER. MACHINIST.

Large Russian firm having German, French and English agencies, is wanting good agencies for textile machinery and machine tools of all kinds. "Industry," AMER. MACHINIST.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

We have hundreds of steel disks, 3¼ and 3½ diameter, ¼, 3/16, ¼ inch thick, annealed; this is Crucible Steel Company's sheet tool steel; it is a by-product in the manufacture of rotary paper knives. Samuel M. Langston, Camden, N. J.

Wanted—Second hand electric, overhead traveling crane, 40-foot span, main hoist 35 feet lift; no auxiliary needed; suitable for handling clam shell bucket of one and one-half cubic yards capacity; current to be alternating, 220 volts, 3 phase, 60 cycles. Address Box 138, Anderson, S. C.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Pierce Manufacturing Company, Woonsocket, R. I.

Wanted—Party or parties to buy outright or to take a license on the basic patents on the only automatic continuous solids and filter press in existence, pressing between cloths, loading and unloading automatically; pressing can be regulated to any extent with or without hydraulic or screws, or it can be run as an ordinary press at the same time doing away with the trouble of taking apart the machine to remove the cakes; manufacturers will require no special machinery; the press can be seen in operation and a thorough investigation made of its many possibilities. K. S. Berrigan, sole owner, 136 North Centre street, Orange, N. J.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—Experienced rate fixer; man competent to take full charge of rate department; must have knowledge all classes of machining operations large and small work; in reply state salary required and when disengaged. Box 156, AMERICAN MACHINIST.

ILLINOIS

Wanted—A first class assembler and adjuster on small complicated mechanism; must be an all-around mechanic with executive ability, capable of taking charge of our assembling department after learning our work; state age, experience and last four places employed; location, Chicago. Box 154, AM. MA.

Wanted—Salesman to sell a leading brand of high speed and carbon steels; one who has a thorough working knowledge of such steels and is able to demonstrate them, is required; a man familiar with the modern States of the Middle West is preferred. Write, giving particulars of age, salary expected, experience, etc., to Box 157, AMERICAN MACHINIST.

INDIANA

Wanted—A few skilled toolmakers by a well established manufacturing firm, located in Indiana; applicants must be of high character and enterprising in their work; state character of work best skilled in, age, experience and give references. Box 170, AM. MACH.

Wanted—A man who has made gearing and gear cutting a specialty; one who understands gearing technically; interesting proposition for right party. Box 111, AM. MACH.

Wanted—We employ Cleveland and Brown & Sharpe automatic turret forming machines, Potter & Johnston and Jones & Lamson turret lathe, also automatic gear cutting machines; we want a man skilled in the operation of some or all of the above, who is thoroughly qualified to operate and superintend to best advantage. Address, stating age, experience and give references. Link-Belt Company, Indianapolis, Ind.

IOWA

Wanted—Machine shop foreman; must be competent in building pneumatic machines; state age, experience, salary wanted, whether married, etc. Box 155, AMER. MACHINIST.

Wanted—General superintendent, capable of taking complete charge of thriving and fast growing factory making general line of steel stampings; location in good mid-western city; runs about thirty punch presses, with full supplemental equipment, employs seventy operatives; must be first class executive, good disciplinarian, able to handle labor, and to turn out the work; only thoroughly equipped and experienced man need apply; place demands a good man and will pay for him, but wants full value received; no beginners or failures wanted, but the chance of a lifetime for the right man; state fully and clearly your qualifications, experience, age and salary desired; all will be held strictly confidential. Address "X," Box 50, AM. MA.

KENTUCKY

The Universal Stenotype Company, Owensboro, Ky., organizing factory for production of writing machine, requires services of toolmakers, die makers, machinists, screw machine men and punch press men; only applications from mechanics having best of references will be considered; young men preferred; fine opportunity for rapid advancement; state what salary expected. Address "Superintendent," enclosing references.

MASSACHUSETTS

Wanted—One special mechanic (machinist) at $4 per diem; a competitive examination will be held August 21, 1911, for the purpose of filling the above position. For further information address "Commandant," Navy Yard, Boston, Mass.

MICHIGAN

Wanted—Gear expert; a large corporation will employ a first class bevel gear man who understands thoroughly the technical as well as the practical side of bevel gear production; must be able to produce highest grade of hardened gears; liberal salary to man who can produce the goods; state age, experience and salary expected. Address Box 113, AM. M.

MINNESOTA

Wanted—First class foreman to take charge of manufacture of marine gasolene engines; one who thoroughly understands the handling of tools and the turning out of work in first

class order; steady employment and good wages will be paid to the right man. Apply, stating experience, to the Campbell Motor Co., Wayzata, Minn.

NEW JERSEY

We will have openings for machinists and toolmakers during July; mail your application, giving references and wage at last place. Crane Motor Car Company, 96 West Seventh street, Bayonne, N. J.

NEW YORK

Wanted—Draftsmen, experienced on tools, jigs and fixtures for the manufacture of small interchangeable parts; state age, experience in detail and salary expected. Box 124, AM. M.

Wanted—Machinists wanted. lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Wanted—A machine tool salesman for office of foreign selling branch; must be familiar with standard American lines; good opening for right kind of man. Address, giving age, experience, references, compensation expected. "K Q W," AMER. MACHINIST.

Salesmen Wanted—If you call on the hardware or factory, mill and mine supply trade, we can make you the best selling proposition that we have had to offer in all our 59 years of business life; if territory can be arranged we will gladly furnish particulars, and we want only experienced men. Address "Chebeco," AMERICAN MACHINIST.

South America—A combination of automobile manufacturers are looking for the right man to act as their traveling representative in Argentine and Brazil; he must have a successful business record in those countries; previous automobile experience not essential; will probably lead to permanent resident in Buenos Ayres. Box 163, AMER. MACHINIST.

Wanted—Machinery salesman, live and energetic, with theoretical and practical experience in gear cutting, for selling high grade, well known line of modern gear cutting machines; first class opportunity for capable hustler; state age, salary desired, former experience and territory covered; only men with thorough experience in gear cutting line will be considered. "S. G.," AMER. MACHINIST.

Export—A combination of manufacturers are looking for the right man to open their Paris office, and to manage and develop their business throughout Europe; business experience acquired by long residence in Europe, as well as a successful record there, is essential; the business is motor cars, but experience in the automobile business is not required; your replies will be considered confidential. Box 164, AMERICAN MACHINIST.

NORTH CAROLINA

Wanted—German-American mechanic, who has some knowledge of mechanical drawing, as foreman of machine shop in small town; state experience, present position, age and salary expected. S. Parker, Pine Town, N. C.

OHIO

Wanted—First class draftsman familiar with designing planers and boring mills. The Cincinnati Planer Co., Cincinnati, O.

Wanted—Communication with competent makers of steel castings, for engagement as superintendent of a proposed steel foundry; fine prospects; state experience and give references. Answer, "Davidson," AMER. MACH.

Wanted—An office manager with practical experience in mechanical lines and is able to invest $5000 for ¼ interest, in manufacturing a machine that has no competition and is an immense seller. Box 149, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—First class shaper hand for 24-inch Gould & Eberhardt shaper; also first class milling machine hand and grinder operator for No. 2 Cincinnati plain milling machine; men for above positions must be able to do any work within range of machines. Write to Fraser C. McLellan, shop foreman, American Sheet and Tin Plate Co., Monessen, Penn.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Experienced scraper fitters wanted on medium light machinery, near Providence; only replies stating experience and minimum wage will be answered. Box 172, AMER. MACH.

WASHINGTON

Wanted—An assistant foreman, young and uptodate, who understands sawmill and engine work, to have charge of floor and bench hands; from 15 to 30 men under him; good job for the right man. Address, Sumner Iron Works, Everett, Wash.

WISCONSIN

Wanted—General foreman and department foremen for machine shop (400 men) in modern works manufacturing automobile parts; applicants with mechanical and executive experience on interchangeable and repetition work, using uptodate equipment, will be considered; state age and experience. Box 174, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Mechanical draftsman, 29, college graduate, naturalized American, with 2½ years shop and seven years designing and checking experience in various lines of machine building, especially fine and automatic machinery, desires change; office or shop; location, Canada or United States. Box 162, AMER. MACH.

CONNECTICUT

Expert tool designer, six years' varied practical experience, capable taking charge. Address "Designer," General Delivery, Hartford, Conn.

Has some large manufacturing concern an opening for an experienced high-grade general manager or superintendent? I am a good organizer, systematic and uptodate on tools and modern methods; am capable of producing the highest grade work at the lowest cost; best of references furnished as regards character, ability and experience. Box 168, AM. M.

MASSACHUSETTS

Position as tool and die room foreman; have had wide experience as foreman and tool and die designing; shell drawing a specialty; can furnish A-1 references. Box 141, AMERICAN MACHINIST.

MICHIGAN

Technical graduate, 28 years, seven years' practical experience as machinist, draftsman, technical correspondent and in charge time, cost, stock and premium systems; now employed as factory manager, but desires to change to broader field; specialty of practical but efficient systems. Box 160, AMER. MACHINIST.

NEW JERSEY

Experienced engineer and designer, expert on shop practice, cost system, etc., wishes responsible position with first class concern. Box 171, AMERICAN MACHINIST.

Efficiency engineer, conversant with theory of uptodate efficiency methods and their practical application, in responsible position, desires change. Box 152, AMER. MACHINIST.

Purchasing agent and office manager in large manufacturing concern would make advantageous change; nine years' experience in machine shop and manufacturing requirements. Box 159, AMERICAN MACHINIST.

Draftsman, experienced on the design, erection and operation of suction gas producers and gas engines, from 6 to 150 horsepower, desires position; graduate in mechanical-electrical engineering. Box 158, AMER. MACH.

Wanted—Management of medium size factory feeling strain of competition or lacking progressive spirit, by mechanical engineer of thorough training and experience, familiar with high class work and correct methods; salary nominal plus commission on increased profits; must be convinced of broad possibilities of field. Box 145, AMER. MACHINIST.

NEW YORK

Foreman, tool room and modern manufacturing training, desires to change; reference first class. Box 137, AMERICAN MACHINIST.

Foreman machinist, steady, industrious, first class mechanical and executive ability, desires change, responsible position only; age 33; A-1 references. Box 167, AMER. MACH.

Draftsman (22), technically educated, four years' shop, one year's drafting room experience, wants position in big concern with hope for advancement; good references. Box 178, AMERICAN MACHINIST.

German machinist and toolmaker, 37 years, 19 years' experience in tools, automatic machinery, also die work, good reference, wants steady position, New York or vicinity. Box 176, AMERICAN MACHINIST.

Gas engineer-machinist, age 23, five years' experience installing, repairing and operating gas engines, open for engagement August 15; stationary operating preferred; best references. Box 166, AMERICAN MACHINIST.

Designer, six years office, nine years shop on shop tools, automatic cigar, stopper, paper machinery, experimental work, etc., desires position of responsibility with growing concern; good executive. Box 179, AMER. MACH.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Superintendent and factory manager, high class and efficient, expert on tools, dies, gages, machine building, interchangeable parts, foundry, structural steel and sheet metal products; thoroughly understands handling help, hustling out work; production my specialty; never failed to exceed all expectations; now employed. Box 165, AMERICAN MACHINIST.

Chief draftsman, assistant superintendent, wants a bigger and better job; inventive ability, a practical tool designer, a top notcher on intensive production and an able handler of men; at present employed in a plant of 600 men manufacturing several lines of medium weight machinery; 15 years' experience. Write for more particulars Box 173, AM. MA.

Mechanical engineer is open for an engagement; technical education and thoroughly familiar with modern cost and manufacturing systems; have had more than twenty years' experience as foreman, superintendent and master mechanic; large experience in the designing and manufacture of small and medium high grade machinery, automobiles, sheet metal goods and electric instruments. "G. W. N.," 732 Marcy Ave., Brooklyn, N. Y.

OHIO

Wanted—Position as cost accountant; nine years' experience in foundries and machine shops; competent to reorganize and take charge of accounting department. Box 143, AMERICAN MACHINIST.

Has 20 years' experience as designing engineer, chief draftsman and superintendent, splendid record originating and developing new ideas, simplifying and improving old designs, thus keeping product uptodate; available to manufacturer wanting high grade man; now employed. Box 175, AMER. MACHINIST.

RHODE ISLAND

Draftsman, 30, English, small tool specialist, also machine tool and shop layouts; references; moderate salary. Box 169, AM. MA.

A-1 toolmaker and machinist, 20 years' experience in machine shop and tool room; competent to handle men, wants position as machine shop or tool room foreman. Box 142, AMERICAN MACHINIST.

TEXAS

Machine shop and tool room foreman desires change; experience all kinds of work. Box 153, AMERICAN MACHINIST.

WEST VIRGINIA

Situation Wanted—Salesman, machinery or mechanical goods, by an energetic man with 11 years' shop and drafting experience; good appearance and education; any territory. Box 148, AMERICAN MACHINIST.

FOR SALE

For Sale—Set of designs and details for universal milling machine in three sizes, finest designs on the market; splendid chance for firm wanting a specialty to manufacture. Box 161, AMERICAN MACHINIST.

Machinists business for sale in Newark, N. J., employing 15 men; lathes, gear cutters and full equipment doing profitable general and auto parts business; satisfactory reasons for disposal. Apply Box 144, AMER. MACH.

Metal Clothes Lockers—We bought too many and are offering about 300 expanded metal clothes lockers for sale at a sacrifice; all brand new; size 12x12x60 inches; made by Merritt & Co., of Philadelphia; chance to equip your factory cheaply. Metric Metal Works, Erie, Penn.

Machine shop for sale in a manufacturing town in New Jersey; saw tooth roof and steam heated; lathes from 9 inches up to 42 inches; good chance for one or two bright mechanics to invest a few thousand dollars; an excellent opening for automobile shop and foundry along with present business. Box 88, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

Here's an article that's just come in. It is so good that we print it as it is:

What the Advertising Columns Have Meant to Me.

C. A. TUPPER *

From the "Talks with Readers" printed by the AMERICAN MACHINIST, to which my attention has been attracted in the search for current information, I am reminded how, for eighteen years past, I have found in both the reading and display columns of the leading technical journals my most regular and remunerative sources of practical instruction.

The reading pages of every good class publication are, of course, an inspiration and means of instruction for thousands of Americans holding positions of responsibility; but there is, unfortunately, a tendency to overlook many of the possibilities of the advertising section. Therefore, my rather comprehensive experience along this line, and that of associates, may have suggestive value to others.

While the use that I made of advertisements was, at first, of a desultory character, it gradually settled down into a system comprising the following classifications:

(1) Improvements in standard machinery, tools or other appliances.
(2) New apparatus distinctive in design or application.
(3) Changes in operating methods and consequent economies made practicable by both of the above.
(4) Materials and their uses.
(5) Suggestions offered by advertisements of competitive machinery.
(6) Pointers from illustrations and descriptions of non-competitive machinery.
(7) Good selling arguments.
(8) Weaknesses in our own or competitors' machinery revealed by the application of the "deadly parallel."
(9) New fields of operation in which to introduce our machinery and extension of the sphere of industrial applications.

The first four of these had to do primarily with manufacturing, i.e., shop economy, including purchasing. The last five concerned designing and selling, with, of course, advertising. But they were all coördinated to a common end. The idea, as it developed, enabled us to put into continuous operation an "efficiency" system of our own which, for practical results, was superior to most of those that I have seen worked out, in late years, by the most capable experts in that line. Every improvement, being gradually brought about, created no disturbance of the existing system, and there was a steady gain in working economy, as a consequence of full and free discussion of the various suggestions brought before our department officials, superintendents and foremen for discussion.

The clippings of advertisements which came under the first of the above headings, viz: improvements in standard tools, would, if they had all been preserved, form a continuous record of the manufacture of equipment for pattern shops, foundries, machine shops, erecting floors and boiler or tank making. For giving a birdseye view of the latest developments in any particular line, they were simply invaluable, and they also prevented us from wasting too much time on an apparently new device, for which great claims were made, when we discovered that something similar had been tried out and had proven a failure some years before, as shown by notations in the scrap book. This is not to say that no further consideration was given such a device, for changing conditions might have altered the situation materially with respect to its further use; but we avoided useless experimenting.

The practical utility of such a collection of advertisements, which we kept restricted to distinctively new or improved features of standard tools, will be apparent to any thinking man.

The same idea has been carried out by progressive superintendents all over the country. Not long ago I saw the statement of one shop manager who had systematically kept such a scrap book for a good many years past. "Money would not buy it," he said.

Others have placed all clippings in envelopes, filed under the various headings, and this is probably the most convenient method.

The mere preservation, for future reference, of such advertisements is, however, no more than incidental. Their greatest value lies in an immediate consideration of the points which attract the shop superintendent's attention. One of the most successful means of getting the most out of them when they are fresh is to have them passed around at the next foremen's meeting for discussion. A few minutes taken up in this way at frequent intervals will be found well worth while. Another method is to distribute them in envelopes to various men in the establishment and ask for brief verbal or written comments. This plan can be elaborated to quite an extent and, if held within proper bounds, will yield extremely good results.

What I have said above applies also to advertisements of new apparatus distinctive in its design or application; but here the selection is more limited; and greater care should be exercised in considering the practical utility of any new tool. Experience has shown that, as a rule, it is poor business to throw out one machine and put in another, or to add to equipment, merely because of a favorable impression or the persuasive arguments of a salesman. On the other hand, however, it is frequently possible to cut down costs or improve products, or both, by the purchase of an advanced line of equipment; and the wide-awake shop manager must be on the lookout, all the time, for such opportunities. To him the advertising section of the leading paper in his line of work is a treasure house of possibilities. It is true that he also finds them in catalogues, when he has time to go through the latter; but the advertisements are usually uptodate, which it is utterly impracticable for a catalog to be, and all of the points for his consideration (if the advertisement writer is on to his job) are clearly and concisely put.

Improvements in shop equipment inevitably lead to changes in operating methods, with, in most cases, corresponding economies.

I have found, however, that in bringing about the latter it is not always necessary to install new apparatus. From careful, constant reading of advertisements, and particularly as a result of looking closely at the views of installations, which appear from time to time, my associates and I have derived numerous hints for the rearrangement and more effective utilization of what equipment we had.

The purchase and use of materials in shop work or machinery construction of any kind constitute a subject so large that it can be no more than briefly referred to in a letter of this kind. It has been, however, my observation that the most progressive manufacturers follow very closely the announcements made in the technical papers. Let any new abrasive, alloy or tool steel, for example, be well advertised, and it is a subject of almost immediate discussion from one end of the country to the other. I have frequently tried to tell of something of this kind that I had just observed, only to be interrupted with the remark that my auditor already knew of it. If the readers of the technical journals, generally, gave the same degree of attention to other advertisements that they appear to give those of materials, they would benefit accordingly. The reason for the difference probably lies in this: that the supply of material has to be constantly renewed; small economies in purchasing quickly swell to large amounts in the aggregate, and the success of a manufacturer's product, in any line of metal working, depends to a considerable extent upon the material composing it. Therefore, he must constantly be on the alert, and he naturally turns to the latest advertisements as one of the best means of keeping posted. If he gave as much attention to the possible economies to be effected in the operation of tools as he does to clipping a few cents per ton off the cost of the material on which the tools are working, he would find that it paid him just as well, or better, in the end, and he could derive his information from the same sources.

There are many ways of getting information out of the papers soon after they come in.

One way is to so distribute the reading of these papers among a number of subordinates as to make it a burden to none of them, requiring each to keep the executive informed of the latest developments in some particular field, clip articles and advertisements that he ought to read or mark them for his attention. For this purpose there ought to be in every establishment at least two copies of such a paper as the AMERICAN MACHINIST, one for clipping and one for the file; and the best results are secured by having enough to be regularly read by every man in the place, whether superintendent, foreman or machinist, who can be induced to take an intelligent interest in the progress of the concern.

* * * *

Only reliable products can be continuously advertised.

*Efficiency engineer, Milwaukee, Wis.

Machining Typewriter Frames

By Ethan Viall*

Jigs, fixtures and gages used in the machining of typewriter frames.

The way multiple spindle drills are set for various jig layouts and a method of drilling closely spaced holes.

A jig of the floating clamp type for thin castings and the gaging fixture used for them.

*Associate editor.

In the big plant of the Union Typewriter Company, Bridgeport, Conn., where the Yost writing machines are made, there are many special machines, fixtures, jigs and gages, of more than ordinary interest, which will be described from time to time, but of the many parts of a typewriter, the frame naturally comes up first for consideration when discussing manufacturing methods.

The first operation on the frames is to mill the top surfaces and the second operation to mill the main rail seat, the frame being held in a suitable jig, which will not be shown here, but the feeler gage used to measure the depth of the rail seat as well as a frame which has just been milled as described, are shown in Fig. 1.

This type of feeler gage will be interesting to those not familiar with it, as

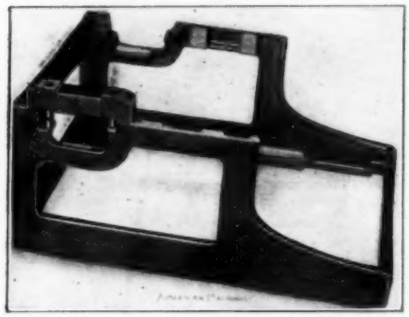


FIG. 1. MAIN FRAME RAIL-SEAT FEELER GAGE

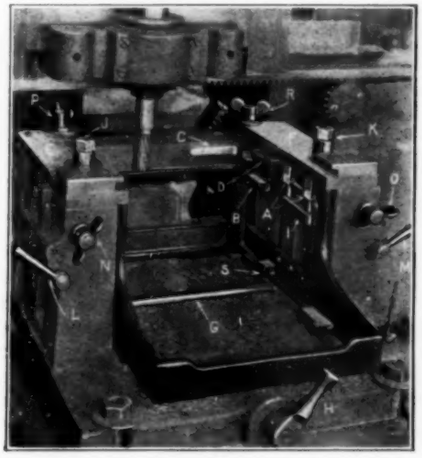


FIG. 2. MILLING SEGMENT SEAT AND BELL PAD

almost infinitesimal differences may be felt. In the Union Typewriter factory the principle is used in many ways on various gages, but in this case the gage consists simply of the bar *A* into which are set two sliding pins *B* and *C*, the tops of which are exactly level with the top surface of the bar when their lower ends are down the correct depth.

If the seat to be gaged is cut too low, the tops of the pins will be below the surface of *A*, and if the seat isn't deep enough, the pins will project, in either case the variation from the correct depth being easily detected by running the fingers across the tops.

After the top and rail seat have been milled to gage, the frames are placed in the jig in the vertical miller, Fig. 2, and the segment pads *A*, and bell pad *C*, finished with the mill shown in the halftone.

DETAILS OF THE MILLING JIG

The frame is located in the jig so as to be square with the table feeds, as follows: The rail seats previously milled fit two blocks like *D* and the milled top of the frame butts up under the two plates *E* and *F*, being forced up, previous to clamping, by the flat spring *G* operated by the eccentric lever *H*. The clamping is done by two clamps like *I*, which are drawn up by tightening the nuts *J* and *K*. These clamps are so made that they work in slots cut crosswise in plates *E* and *F*, so that they may be slipped back out of the way when putting in or taking out the frame.

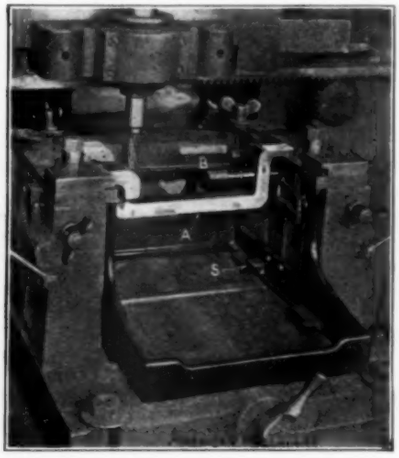


FIG. 3. GAGING THE MILLED SURFACES

Backing is given to the frame sides where needed to steady or support them during the cut, by spring plungers operated by levers *L* and *M*, which accommodate themselves to any unevenness of the casting and are locked when set by

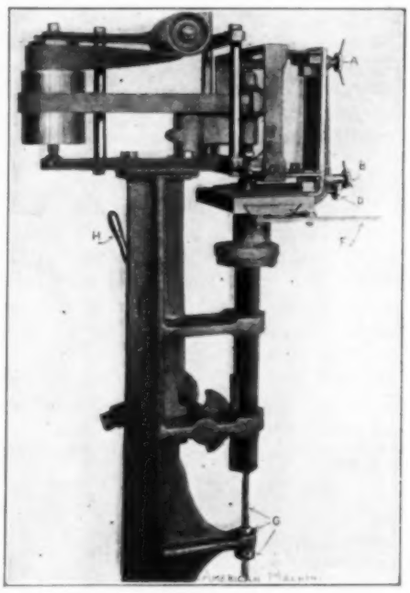


FIG. 4. SPECIAL MACHINE FOR PROFILING INSIDE OF FRAME

tightening the thumb nuts *N* and *O*. Hook clamps are also provided for holding up the back of the frame, which are tightened by means of the thumb nuts *P* and *R*.

The correct distance between the milled pads on the sides of the frame is measured with the gage *A*, Fig. 3, which carries the micrometer head *B*.

FIG. 5. MASTER PLATE USED FOR SETTING SPINDLES OF MULTIPLE DRILLERS

A Special Miller

Lug *S* and a similar one on the opposite side, are milled off in the special machine shown in Fig. 4. As before, the frame is located by the surfaces milled on the top, being clamped against the fixture by means of the two hand screws *A* and *B*. The frame is supported under the cutter by a spring plunger at *C*, which is locked by the hand screw *D*.

When putting in a frame the fixture carriage is run toward the right end of the cross slide when the operator is facing the machine, and the frame slipped into place and clamped, then the work is fed past the cutter by means of the hand lever *F*. The table is adjusted for hight by means of the screw and nuts *G*, the gear segment meshing in the rack and operated by the hand lever *H*, not being used during the milling operations shown.

Drilling the Frames

Following the milling operation, comes the drilling, which is principally done in multiple-spindle drillers, the drill spindle layout for the various jigs being taken from master plates similar to the one shown in Fig. 5, the holes of which fit over the ground shanks of the drills in the spindles. The large holes in each corner of the plate are intended for legs to finish the holes, as it is impossible to set the drill spindles close enough to do so in one operation and in the example shown, the right-hand holes of each pair are drilled with drills *A A*, and then the jig is moved to the left and the left-hand holes are drilled with drills *B B*. In the first drilling operation, the jig is set against a strip *C* at the back and also against the corner stop *D* and then when the first four holes have been drilled, it

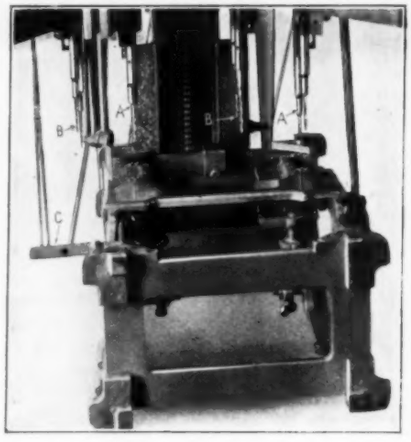


Fig. 7. Drilling Closely Spaced Holes—First Position

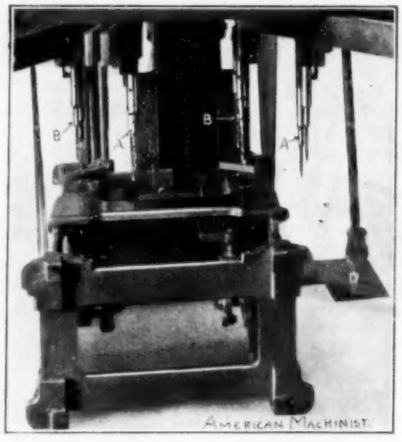


Fig. 8. Drilling Closely Spaced Holes—Second Position

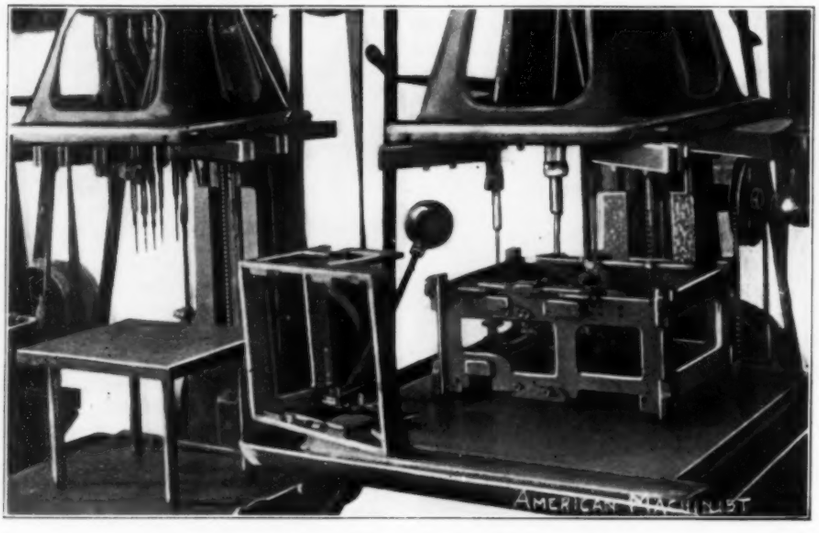


Fig. 6. Master-plate Table and Frame Jig

used to raise the plate above the driller table and facilitate setting, a master plate with legs in place being shown at the left in Fig. 6 and one of the drilling jigs at the right.

Drilling Closely Set Holes

When necessary, several multiple-spindle drillers are used, so that all the holes in a frame may be drilled without removal from the jig. Where the holes to be drilled are well apart, only one layout is needed to finish a set of holes, but where the holes are close together, as shown in Figs. 7 and 8, two separate drill layouts are used on the same machine is moved along the strip *C* until it comes in contact with another stop, not shown, and the drilling completed.

Driller Attachment for Inside Holes

Some of the dowel-pin holes are drilled from the inside of the frame, which is done by using the extension driller heads shown in Fig. 9. These extension heads are made so as to be easily attached to the regular sensitive driller column and may be taken off when the driller is wanted for other jobs. In the extension head *A* the spindle *B* is run by a chain of spur gears from the regular spindle *C* and the drill is fed up or down by means of a hand lever operating a pinion meshing with a rack on the spindle, in the same manner as on a standard driller.

In the cut one head is shown within the frame reaming a dowel-pin hole that has been drilled by the head seen outside the frame.

Rack for Holding Parts

To facilitate the handling of frames in the various operations and for moving from one machine to another, they are hung on upright trucks or racks, holding 42 frames, as shown in Fig. 10. These racks are rolled up close to a machine and a frame taken off, the operation completed, the frame put back on the rack and the next one removed, and this is kept up until the entire 42 have been through that particular operation, when the rack is wheeled to its next station. The use of these racks *B* preserves the part, saves all unnecessary handling as well as space, keeps the shop from being all cluttered up, and they are also used for a number of other typewriter parts.

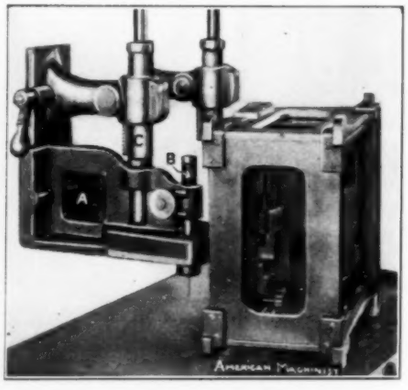


Fig. 9. Attachment for Drilling Dowel-pin Holes on Inside of Frame

Milling and Gaging Frame Tie Plates

Frame tie plates are milled in two operations using one gang of cutters and

FIG. 10. FRAME TRUCKS

at the back, and the two lower pieces on which the casting rests also slide in grooves crosswise of the plate and are locked by small eccentric levers in front. The top clamp is pivoted in the middle as are both of the end pieces, and the middle of the semi-circular part of the plate is supported by a spring plunger *R* which is locked after the top clamp is in place by means of the thumb screw *S*. The top clamp is locked by a hook operated by lever *T*.

GAGING TIE PLATES

In gaging the milled surfaces, the spots are checked up by the feeler gage *U*, which is made to set on the bed plate of the fixture, as shown in the right-hand cut. The ends are gaged by feeler plugs *V V* and the slotted places by the sliding gages *W W*. The centering of the tie plate in the gaging fixture is done in practically the same way as in the milling fixture, the centering piece *X* being fastened to a cross slide held tight by a spring underneath, and it is locked by turning the handle *Y* which at the same time locks the clamping levers *Z Z* by means of the eccentric shown.

Radiator efficiency is practically unaffected with radiators of the same shape made of different materials, cast iron, wrought iron and copper, as far as the heat radiation is concerned when painted with similar coatings of paint, according to the results of tests recently made at the University of Michigan. This is due to the fact that the total heat radiation is determined by the region of greatest resistance to the transmission of heat. This point is at the surface, so that the material of which the radiator is made (which is always a good conductor) has very little effect. For the same reason the thickness of the metal composing the radiator has very little effect.

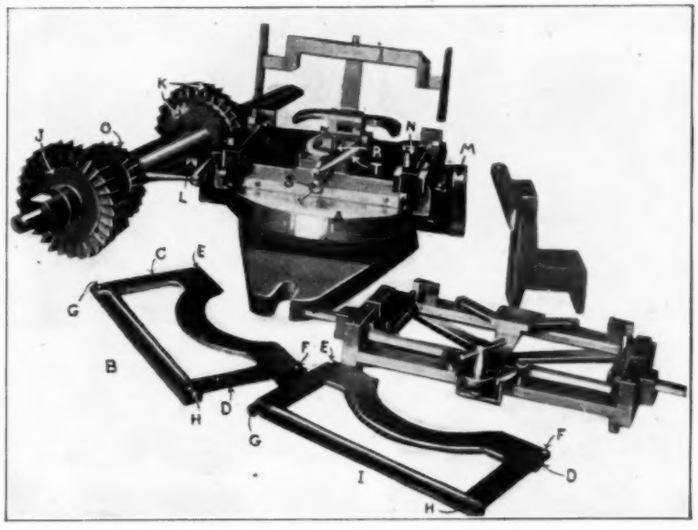


FIG. 11. FRAME TIE-PLATE MILLING FIXTURE AND GAGES

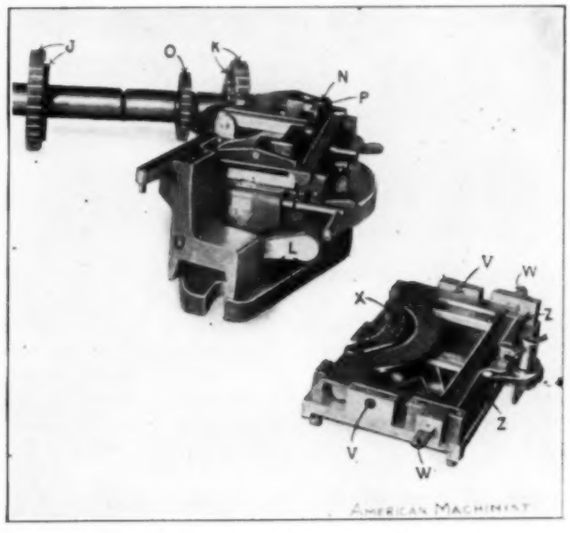


FIG. 12. FIXTURE CLOSED AND GAGES IN USE

one jig, all of which, with the gages, are shown in Figs. 11 and 12. *A* shows the jig open, ready to receive the plate *B* which is to be milled on each end *C* and *D*, on the spots *E* and *F* and cut away at *G* and *H*, as shown at *I*.

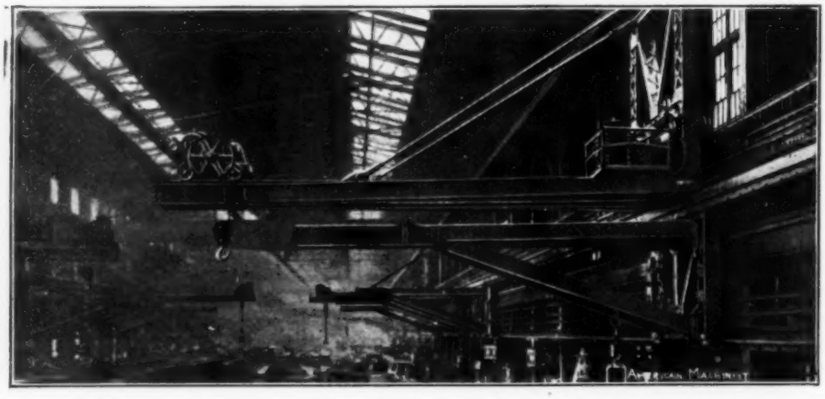
The jig as shown at *A* is in position for milling the ends and spots, using the cutters *J* and *K*, more clearly shown in the second halftone. After this milling operation is finished, the jig is indexed a quarter turn by loosening the clamps operated by levers *L* and *M*, pulling up pin *N* and turning the table of the jig till the pin drops into the locating hole, when the clamps are again tightened by the levers and the parts *G* and *H* of the tie plate cut away with the cutter *O*, which during the previous milling operation passed harmlessly through the slot *P* of the top clamp. It will be seen that owing to the springy nature of the tie-plate casting, the clamping scheme of the jig is of the floating type. The C-shaped stop at the back of the jig is made to slide backward or forward, being held by a spring so as to center the casting and yet let it rest against the two solid stops

Economy in the Use of Cranes

By C. A. Tupper

During recent tours of large foundries, machine and assembling shops, iron and steel plants, etc., both in this country and abroad, it has been forced upon my attention that one important element of manufacturing economy is very generally overlooked, while, in isolated instances, it has been taken advantage of to an unusually full extent. This is in the selection and arrangement of cranes for various purposes, with their intelligent, systematic application to the work in hand. As a rule, very little thought appears to have been given the subject.

In this article, particular attention will be called to the use of auxiliary traveling wall cranes, working beneath and in conjunction with the larger overhead cranes. Wall cranes are especially suited to handling detail work; as, for example, when a casting is to be put on a machine or shifted, flasks handled in the foundry, ladles filled at the cupola, repoured or removed to a spot where the overhead traveler can pick them up, or shapes held for riveting in a bridge or structural plant. Each of these operations is apt to require considerable time and ties up the large crane for a longer period than is economical. Stationary jib cranes are, of course, largely used for such work; but they have too many limitations. A traveling wall crane will do all that the jib crane is capable of performing; and, on account of the ease with which it can be moved up and down the shop without interfering with the overhead crane, it can be called upon for a much greater variety of service.



A Combination of Overhead and Wall Cranes

Within the past decade, with the increasing size and complexity of the work, there has been a tendency on the part of many managers of large metal-working plants to install more cranes, of the heavy overhead type, than they actually need; and, notwithstanding this condition, there is not only a remedy provided, but operating expenses may frequently be reduced and greater flexibility of service attained.

An example of the better practice is shown in the accompanying figure, reproduced from a photograph taken in the works of a large bridge company. The number and arrangement of the wall cranes, and their relation to the large overhead traveler can be readily noted. This represents a combined system installed by the Alliance Machine Company, Alliance, O., which is very economical.

In a large shop consisting of a main bay and one or more side bays or leantos, the combination of wall cranes, for the latter, with an overhead traveler for the central span, and trucks on cross tracks at ground level for transferring loads, will frequently enable the use of more than one large crane to be avoided. As it is, the visitor to many shops finds the side bays provided for almost as elaborately, in the way of overhead travelers, as the main part of the plant, although the work handled in them is, as a rule, much lighter.

It is not meant, of course, to imply in this article that wall cranes are the only means of effecting the economies mentioned, as other combinations may often be worked out to advantage, depending upon local conditions; but, under any circumstances such as those above indicated their use is well worth considering.

Constant Temperature in Electric Hardening of Steel

By Robert Grimshaw

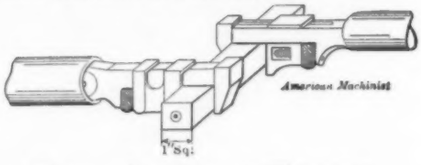
Where electricity is used as a method of heating a hardening or annealing bath, it is necessary to have a voltmeter, with accompanying safety fuse and switches, and a pyrometer. The latter indicates the temperature attained, and the former enables this to be kept constant.

As regards the pyrometer, of which there are many forms, more or less reliable and convenient, it may be remarked that by reason of the radiation from the bath—especially upward—the temperature above it is quite high, and as it is impossible to have cooling devices for its handle, the instrument should be bent at right angles in the upper portion, so that its upper clamps shall be beyond the reach of the high temperature which exists over the bath's surface. The bath, which lies between the parallel electrodes, will always have the same temperature, just as an overheated homogeneous copper wire between the two poles, would have the constant temperature throughout its entire length, if of the same diameter throughout—except perhaps exactly at the points of contact. Experiments by C. M. Cohn show that the upper layer of the glowing melted metal salt, for a depth of about 10 to 15 millimeters, serves as a cover only, for the bath proper, and that under this the temperature of the entire bath is the same all through; hence, it can be regulated very simply by means of the voltage of the electrical energy.

Comparative Wrench Strength Test

A novel and effective method of making a comparative test of the strength of wrenches is in vogue at the plant of the Crescent Forgings Company, Oakmont, Penn., manufacturer of "Cresco" monkey wrenches recently described in our columns.

They use a short piece of steel centered at both ends, placed between the lathe centers. The two wrenches to be tested are clamped on each side of the bar, as shown in the accompanying drawing, with a long piece of pipe extending over the handle of each wrench, and a man stationed at each pipe.



Testing Strength of Wrenches

It is obvious that when the men apply pressure each wrench will get the same strain, no matter what length of pipe may be used, and the weaker wrench will, of course, give first.

While break-down tests of this kind are not often necessary in the average shop, there does sometimes come a desire to make a comparative test, and the method herewith shown seems to be both simple and efficient.

An estimate presented in the annual statistical report of the American Iron and Steel Association places the world's production of steel for the year 1909 at 54,127,000 long tons and for the same year the production of pig iron is tabulated at 60,134,000 long tons.

Piston Ring Turning and Grinding

By E. A. Suverkrop*

Two standard machines especially rigged up for turning and grinding piston rings.

Chucking operation efficiently accomplished.

*Associate editor.

Fig. 1 shows a lathe made by the American Tool Works Company, Cincinnati, Ohio, rigged up specially for turning piston rings. It is in use in the Bessemer Gas Engine Company's works, at Grove City, Penn.

The lathe was ordered without a tailstock. The heavy boring and turning slide *X* was built in the shop. The two bars *A* and *B* are carried in the brackets *E* and *F*, respectively. The brackets *F* and *E* are adjustable on the slide *G* not only to suit the various diameters of rings to be turned, which range from 5½ to 18 inches diameter, but also as regards their distance from each other, which regulates the thickness of the rings.

The handle *H* is for quick return of the carriage *G* when the work is finished. The operation is as follows: A turning tool with its cutting edge down is mounted in the bar *A* and a boring tool with its cutting edge down in the bar *B*. The brackets *E* and *F* are then set, by means of screws, one of which is shown at *I*. They are then clamped in position by the screws *J*.

The "pot" *C* is gripped in the chuck and the feed thrown in. The cutting-off tool *D* is mounted in the carriage proper of the lathe and when the two tools *A* and *B* have advanced far enough the first ring is cut off. No great care is exercised in the cutting off. As the rings are ground to thickness in a subsequent operation the operator merely sees that he gets them wide enough to grind to size. The rings vary from 5½ to 18 inches diameter, from 3/16 to 9/16 inch thick and from 5/16 to 1 inch wide. The operator has turned, bored and cut off 100 rings 9 inches in diameter by ½ inch wide in 10 hours. The pots will average about 10 rings each.

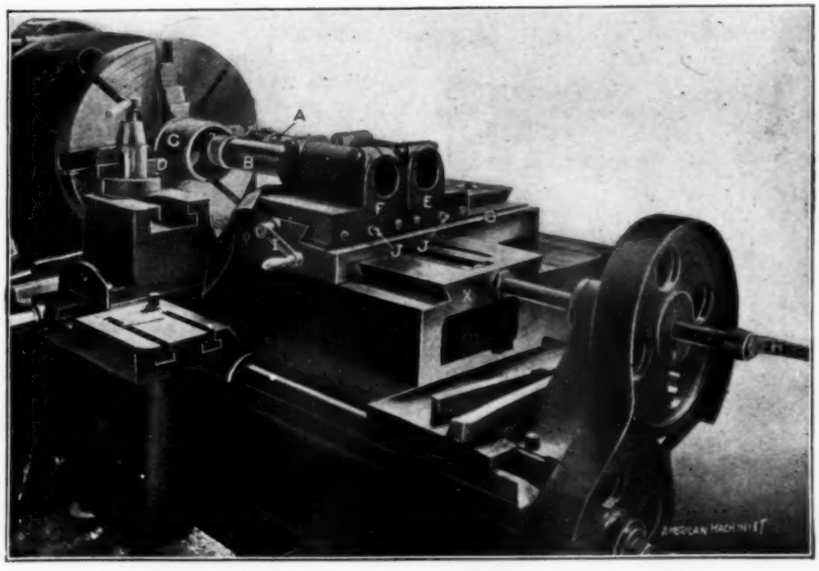


FIG. 1. SPECIAL PISTON-RING TURNING RIG

GRINDING TO THICKNESS

Figs. 2, 3 and 4 show the rig for grinding the rings to thickness. This was also built in the shop and applied to a Gorton disk grinder.

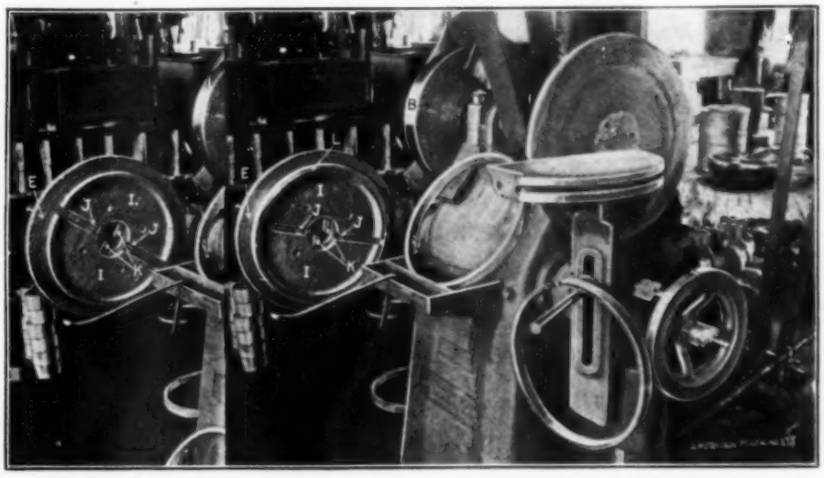
A, Fig. 2, is a cup wheel heavily reinforced with a steel ring chuck *B*. The bracket *C* carries the spindle *D* and face-plate *E*. The lever *F* is for swinging *E* up past the abrasive ring *A*. The bracket *C* has micrometer adjustment to and from the abrasive ring *A* by means of the graduated wheel *G* and screw to which it is attached. On the front face of the face-plate *E* is a 2-jawed chuck with spring-actuated jaws. These jaws are closed by a movement of the lever *H*, but are normally kept open by two springs.

Figs. 3 and 4 show the front of the face-plate *E*.

I I are the jaws which hold the ring. *J J* are the two springs which keep the two jaws expanded. *K* are two links which, in connection with a shaft through the spindle *D*, Fig. 2, and the lever *H*, Fig. 2, close the jaws *I* so that a ring can be chucked. *L*, Fig. 4, shows a ring so chucked.

The swinging frame is now swung up by means of the lever *F*, Fig. 2, so that the ring *L*, Fig. 4, comes in contact with the face *A*, Fig. 2, of the abrasive wheel. As soon as the wheel comes in contact with it, it rotates the ring *L*, chuck *I*, face-plate *E* and the spindle to which it is attached. The grip of the chuck jaws *I* on the inside of the ring is so light that the side of the ring is forced against the true running face-plate *E*. After a lot of rings have been ground on one side the spindle is adjusted to the correct distance and the rings are finished on the other side to give the correct width.

After grinding to width in this way the rings are split, mounted eccentrically on a mandrel and turned to size. In the grinding operation the guard *M*, Fig. 2,



FIGS. 3 AND 4. THE FACE OF THE CHUCK

catches all the dust, which is sucked through the duct *N* to the exhaust system.

Training vs. Production of Apprentices

By John R. Godfrey

There are two distinct problems in the training of boys for the machine trades. The modern large shop requires skilled operators for the machines in its various departments, but has need of but few machinists in the broad sense of the term. The smaller shop, even if it builds a regular product, requires fewer operatives and more machinists, while the repair or job shop needs men who can do any kind of work that comes along.

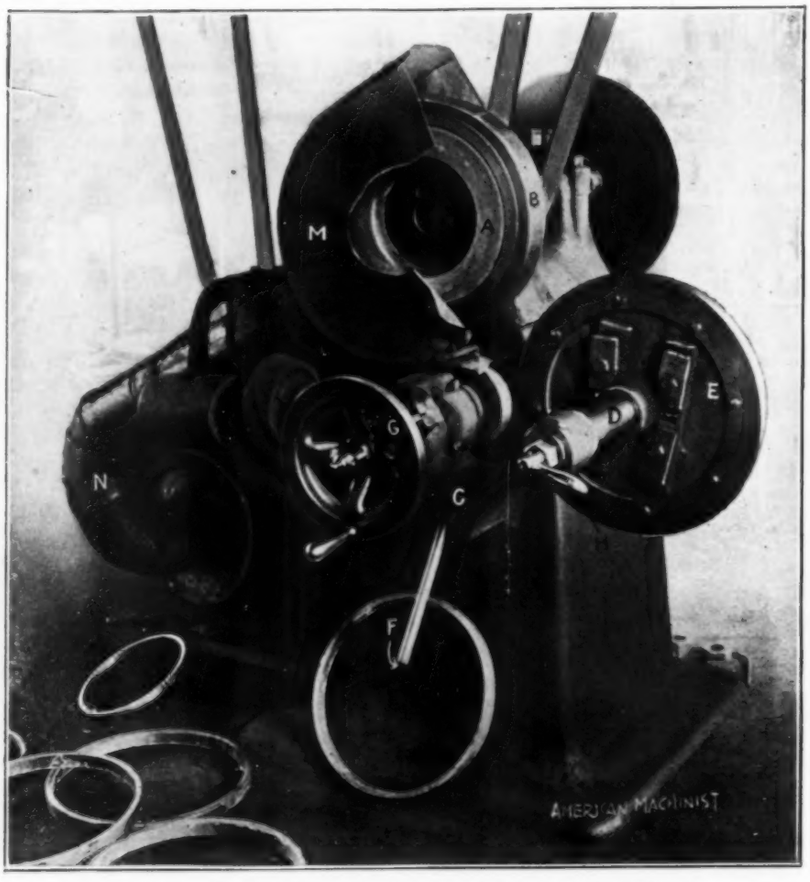


Fig. 2. Special Width Grinding Rig for Piston Rings

We are too apt to think that the percentage of operatives is higher than it really is, because we read more of the systematized shop, where the idea of making the man an attachment to the machine holds sway in too many places.

But there is a much larger field for the all-round man than we imagine. There are hundreds of small shops all over the country, especially in the West and South, where the operative from a specialized factory would not be worth his salt.

There is a growing feeling that our usual term of apprenticeship is much too long; that too much attention is paid to the boy's production and too little to his real learning of the trade; that the actual teaching could be done in one-quarter to one-half the usual time, and that this would do much to make the boy contented instead of chafing under a long term which becomes irksome, simply because it exists.

Many large plants take a bright boy from school or from the farm, as the case may be, and have him handling a miller in a week or two at most. He is not an expert miller hand in that time, but he can run the machine successfully after it is set up. And if he is at all apt, he becomes familiar with feeds and speeds, and often becomes a good operator in a few months.

Taking two weeks as the time needed to give a boy a fair knowledge of the way a machine works, we can give a dozen machines in six months. This will not make a machinist out of him, but will give him a little foundation knowledge as to the way each of them works, and how simple work is done on them. And this without any attempt to get production, simply to get him ready to produce, just as we train boys in business college.

Suppose one of our trade schools, such as Worcester or Bridgeport, should try the intensive system and forget all about production. They would devote all their time to teaching boys how the machines worked and how they were handled. They would turn them over to the manufacturer ready to be taught *his way* and the peculiarities of his work, but they would know how to get any speed or feed, how to run a drill without breaking it, and many things that too many who hire out as machinists do not know.

Nearly every business has its peculiarities, and work has to be done in a certain way, so that even a skilled man must modify some of his methods; but these boys would have no fixed methods and could be molded to the particular way of working desired.

These boys would require instruction in the shop, but perhaps no more than many men; and shop instruction for both men and boys has many advantages, even where the trade has been learned in the good old way.

In fact, in many lines of manufacture it is necessary to train nearly every man hired into a specially developed way of doing work.

An Example of Poor Instruction

There are almost as many ways of looking at apprenticeship as there are apprentices and before we really get down to business in the field of industrial education it will be necessary to determine just what we are trying to do.

Assuming that the object of apprenticeship and apprentice systems is primarily to make skilled workmen, which most of us will grant, it seems clear that the system which can do this in the shortest time should have every advantage. But the foreman and the proprietor have a different idea on the subject.

They want to train the boy, of course, but they also want to get all the productive work out of him that they can at the same time. And the two ideas do not mix any better than oil and water.

One of the first principles of the machinist's trade so far as it applies to lathe work is to see that the piece is correctly centered. But in a well known shop I was going through, which had in operation an apprentice system that has been talked about widely and has a special instructor, I found boys utterly disregarding the centers. Some were running the work without countersinking, while others were running the countersink clear to the bottom of the drilled hole. Neither should have been possible, as a combination counter drill and reamer is the only thing to use in these days in most cases. Through someone's oversight these boys had been allowed to drift on, doing poor work, instead of being taught the rudiments. They were being worked for production but even this was not of the desirable kind.

Indeterminate Terms of Apprenticeship

There is another phase of the question of the time necessary to teach a boy the trade, which may have no practical value and yet may be worth thinking about.

Boys vary in capacity the same as men, some learning in half the time of others. And, just as the indeterminate sentence has proved highly successful in the case of prisoners, so there seems no reason why it might not be the best way with apprentices. For, while we hardly class them as criminals in spite of the way some of them act, there is a similarity in that both are learning better ways and that the length of time necessary varies with the boy.

Assuming that we are trying the intensive farming plan and teaching the fundamentals of the trade in the shortest possible time, there is certainly no reason for keeping a bright boy in the school or training period as long as the slower or backward boy. The only reasons are that the boys' production becomes an important factor and that it is not easy to avoid the charge of discrimination as each boy, or his parents, thinks he is just as capable as the next.

With the boy solely under instruction and entirely without regard to production, it would be to the interest of both parties to get him out of the teaching period and into the shop work at the earliest possible moment. And this without regard to whether the other boys were ready or not.

True, there might be danger in trying to crowd the boy through too fast, but the penalty of poor work after he had graduated into the shop would act as a check on this, because spoiled work soon eats a big hole in the profit account.

Then, too, it should act as an incentive to a boy to know that he would get a chance to earn more money as soon as he was capable of doing the work required. For, with the stipulated three or four years, where the increases are dependent on the calendar and not on the boy, there is too often less incentive than is desirable from any point of view. And the fact that it was indeterminate would add zest to the game.

Would it not be easily possible to have a determined rate and quality of work to entitle the boy to pass to a higher grade, just as class work and examinations do in school? This would remove all charges of favoritism and give a boy something definite to work for.

Grinding and Polishing Hollow Ware

By B. H. Divine

The outside of cast-iron hollow ware, such as frying pans and skillets, can best be polished on compress canvas wheels set up with emery and glued in the usual manner, the number of emery or abrasive being according to the finish desired. The insides of frying pans are usually polished on small diameter V-pointed disk canvas wheels. This wheel is not as efficient as it might be, but is the only character of wheel that can be made to fit this particular job, owing to the small diameter and the angle of the face necessary to reach into the corners of the pan. Flat surfaces, such as the outsides or bottoms of frying pans, kettles, and the general line of hollow ware, are practically compress canvas-wheel jobs, but wheels of different densities can be used to advantage on the different shapes of the work. For instance, flat surfaces of frying pans would take a harder wheel than the curved surfaces of a kettle.

Marks on the Beam of a Crane

By H. K. Spencer*

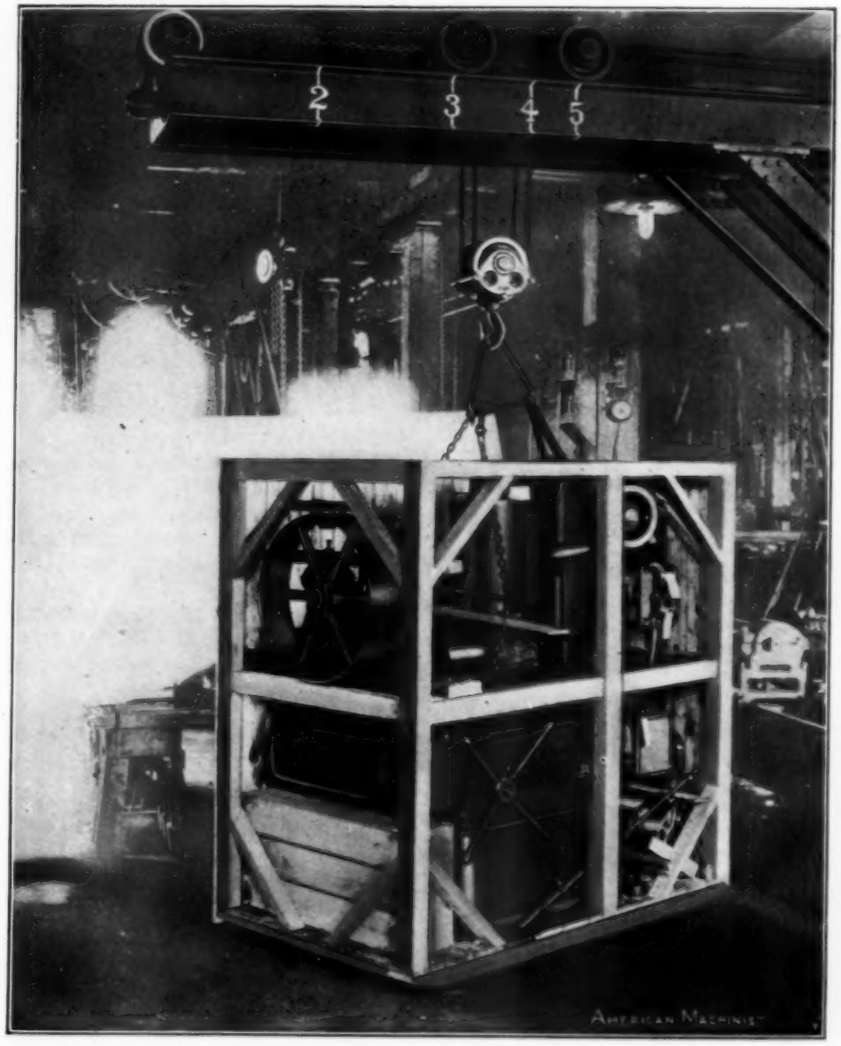
The accompanying photograph shows how we have marked the boom of the crane in our shop with the capacities at the various lengths. These figures indicate the load in tons that can be safely lifted at any one of the particular distances.

In the picture, the crane is lifting a load of about 7800 pounds; the trolley is standing practically at the four-ton mark.

The crane is of the jib type, made by the Case Manufacturing Company and runs on a single rail through the middle aisle of the shop of the Blanchard Machine Company. The two channel irons seen in the photograph are fastened to the ceiling beams.

*Mechanical engineer, Blanchard Machine Company, Cambridge, Mass.

A simple and cheap paint mixture for coating galvanized iron consists of refined coal tar, one of the varieties of black varnish of the tar distillers. It adheres strongly, is elastic and very serviceable. A reverberatory-furnace roof so coated has been in use for 13 years, and is reported to be as good as ever. Ordinary coal tar does not answer the purpose, it is claimed. The tar must be free from tarry acids and alkaloids.



Marks on the Beam of a Crane

High-speed Spiral Gearing—II

By Albert E. Guy *

An analysis of the tooth contact of a spiral pinion and its mating gear whose teeth profiles were accurately determined in a plane normal to the axes. The lengths of the tooth contacts are identical.

Also a discussion of three methods of cutting spiral gears, with emphasis laid on the advantages of the end-mill process.

*Consulting engineer, Trenton, N. J.

It may not be amiss to describe here the method of measuring the length of contact for spiral gears. In the case of spur gearing the contact taking effect on the whole length of one tooth, it suffices to determine the number of teeth of one gear in action at the same time to obtain at once the total length affected.

In Fig. 13, A and B are the centers of two spiral gears, of which R and r are the radii of the pitch circles, R_0 and r_0 the outside radii. The angle $\alpha = 90$ degrees — 14½ degrees = 75 degrees 30 minutes is the complement of the angle of pressure. Line $c\,d$ is the line of pressure; it begins on the outer circle of one gear and ends on that of the gear.

Let $g\,n$ be the arc of action for the large gear and $g_0 n_0$ that for the small gear. With correctly cut gears these two arcs are equal. The problem consists now in finding the angles of action $(\varsigma + \Delta)$ and $(\varsigma_0 + \Delta_0)$.

$$Sin.\ \beta = \frac{R\ sin.\ \alpha}{R_0},\quad Sin.\ \beta_0 = \frac{r\ sin.\ \alpha}{r_0}.$$

From this we obtain readily angles β and β_0.

Then we have

$$\varsigma = \alpha - \beta \text{ and } \varsigma_0 = \alpha - \beta_0,$$

$$[(R + r) - r_0\ cos.\ \varsigma_0]\ tan.\ \Delta = r_0\ sin.\ \varsigma_0,$$

whence

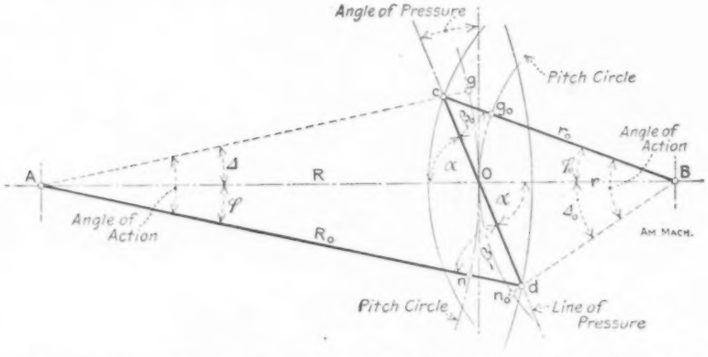


Fig. 13. Diagram for Demonstrating Length of Tooth Action

$$tan.\ \Delta = \frac{r_0\ sin.\ \varsigma_0}{R + r - r_0\ cos.\ \varsigma_0} = \frac{1}{\left(\frac{R + r}{r_0\ sin.\ \varsigma_0}\right) - cotan.\ \varsigma_0}.$$

Similarly,

$$[(R + r) - R_0\ cos.\ \varsigma]\ tan.\ \Delta_0 = R_0\ sin.\ \varsigma,$$

whence

$$tan.\ \Delta_0 = \frac{1}{\frac{R + r}{R_0\ sin.\ \varsigma} - cotan.\ \varsigma}$$

These two equations enable us to obtain the angles Δ and Δ_0. The lengths of the arcs are then:

$$Arc\ g\,n = \frac{2\,\pi R}{360}(\Delta + \varsigma),$$

$$Arc\ g_0 n_0 = \frac{2\,\pi r}{360}(\Delta_0 + \varsigma_0).$$

In Fig. 14 the side $A\,D = B\,C =$ length of arc of action and $g\,n = g_0 n_0$. The side $A\,B$ is the length of the gear, so that $A\,B\,C\,D$ might be called the *rectangle* or *area* of action.

The length l of the active part of one tooth $=$

$$\frac{Arc\ of\ action}{Tangent\ of\ helix\ angle} = l\ in\ inches.$$

The number of teeth in action is

$$N = \frac{length\ of\ gear}{axial\ pitch} = \frac{length\ of\ gear}{circular\ pitch \times cotan.\ of\ helix\ angle}.$$

Total length of teeth in action $= N\,l$.

The total pressure acting tangentially to the periphery of the gear at the pitch line is

$$P = \frac{horsepower \times 33{,}000}{peripheral\ velocity\ in\ feet\ per\ minute}$$

$p = \frac{P}{N\,l}$ = pressure in pounds per lineal inch of tooth contact.

Let us apply this method to a set of pinion and wheel that I designed a little over a year ago and which were very successful when recently tested. The pinion is driven at 3600 revolutions per minute by a multi-stage turbine, and it drives the gear mounted on the power shaft at 500 revolutions per minute.

	Pinion	Gear
Number of teeth	33	238
Circular pitch	0.62832″ or 5 diametral pitch	
Pitch diameter	$\frac{33}{5} = 6.6''$	$\frac{238}{5} = 47.6''$
Addendum	0.188″	0.188″
Outside diameter	6.976″	47.976″
Helix angle	22° 30′	22° 30′

Angle of pressure 14° 30′

Length of gear $R_1H_1 + L_1H_1 = 20''$; horsepower intended = 1200.

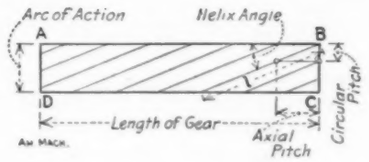


Fig. 14. Rectangle of Action

$$Sin.\ \beta = \frac{47.6 \times sin.\ 75°\ 30'}{47.976} = 0.96056$$

$$\beta = 73°\ 51'\ 17''.$$

$$Sin.\ \beta_0 = \frac{6.6 \times sin.\ 75°\ 30'}{6.976} = 0.91596$$

$$\beta_0 = 66°\ 20'\ 35''.$$

$$\varsigma = \alpha - \beta = 1°\ 38'\ 43''.$$

$$\varsigma_0 = \alpha - \beta_0 = 9°\ 9'\ 25''.$$

$$\Delta = 1°\ 20'\ 41''.$$

$$\Delta_0 = 12°\ 26'\ 26''.$$

$$(\Delta + \varsigma) = 2.99°.$$

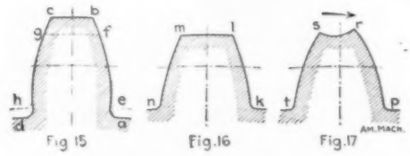
$$(\Delta_0 + \varsigma_0) = 21.597°.$$

$$Arc\ g\,n = \frac{\pi \times 47.6''}{360} \times 2.99° = 1.242''$$

$$Arc\ g_0 n_0 = \frac{\pi \times 6.6}{360} \times 21.597° = 1.244''$$

average 1.243″.

The slight discrepancy observed here results from neighboring decimals which,



Comparison of Tooth Profiles

however small, are of importance when dealing with such small angles.

These calculations are intended to furnish concrete proof of the equality of the two arcs of action. Otherwise these arcs might have been determined approximately much quicker graphically.

$$l = \frac{1.243}{tan.\ 22°30'} = 3''.$$

Number of teeth in action

$$N = \frac{20}{0.62832 \times cotan.\ 22°30'} = 13.18.$$

$$Peripheral\ velocity = \frac{500 \times \pi \times 47.6}{12} =$$

6230 *feet per minute.*

Total pressure on pitch line

$$P = \frac{1200 \times 33{,}000}{6230} = 6355\ pounds.$$

Pressure per lineal inch of contact

$$p = \frac{6355}{13.18 \times 3} = 160.62\ pounds.$$

This pressure is quite light, and in addition, the teeth are of the standard involute type with dimensions established on the circular pitch basis, and the helix angle is small, which allows the gear the advantages of the spiral type and at the same time leaves almost the same facility for milling the teeth as obtains with the straight spur gear. The machine ran noiselessly and should prove serviceable.

Deformations of the Tooth

To design a spiral gear on the normal pitch basis means, in the first place, using a short or stub tooth. Whether such a tooth is more or less advantageous than one of standard hight is still an open question. For spiral gears with a steep helix angle, of say 45 degrees, the stub tooth is easier to cut, the interference with the cutter being much less than with the longer one. For small angles experience indicates the advisability of adopting the standard form.

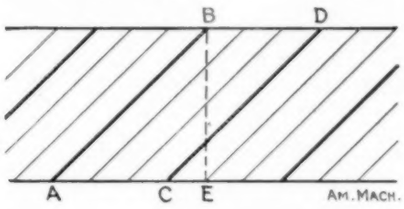


Fig. 18. Diagram of Sequence of Cutting Teeth

In Fig. 15 the profile *a b c d* is that of a standard tooth suitable for the pinion we have studied first. This profile is viewed on a plane normal to the axis and is based on the circular pitch. Profile *e f g h* is laterally the same as the standard but its hight is that of the normal pitch form. Good results should be had with either of these teeth. In Fig. 16 is the resultant profile when the spiral teeth are cut with a standard involute cutter suitable for the normal pitch. This shape, as we have seen, is not correct and requires a good deal of grinding before it can be used.

Fig. 17 shows what happens to the profile in Fig. 16 when put to work after insufficient grinding, or sometimes, in spite of the blind operation called grinding. Such a deformation should be expected after inspection of Figs. 7 to 12, inclusive. There it is seen plainly that the top end does all the work at the beginning of contact, while the rest of the working face does not even come into contact. An excessive pressure results which tends to deform the tooth as at point *r*. After this deformation is effected, contact takes place all along the profile, but with more or less sliding.

At the corner *S* there is also a deformation, although no work is done there, that being the back edge of the tooth. It would be very difficult to explain this trouble without actual observation on the test blocks or on the road. And even well seasoned road men who, when sent out on gear trouble, feel at once the edges of the teeth for traces of deformation cannot explain the occurrence. Invariably when this deformation takes place the gears have been subjected to intense vibration. Because of the wrong form of tooth the pinion of the high-speed shaft has been forced out of its position and brought back with force through its own elasticity, and that many times a second, the effect being similar to that of a wedge-shaped hammer striking repeatedly the inclined walls of a slot.

It is often possible to cure this trouble without returning the gears to the shop. The burs are turned off, or filed off, and the gears are carefully ground at the place of operation. In such instance it seems as if the gears, seeing how unsuccessful the precise cutting operation, capped by expert grinding, had been, had undertaken to form themselves to suit the requirements of actual service.

The Milling of Spiral Gears

Spiral gear teeth may be cut by three different methods; namely: By end milling, by using a single-tooth cutter and by hobbing.

With any of these methods the *correct shape* of the tooth is obtained only when *the shape of the cutter itself is made specially to suit the work*. It follows from this that *all standard forms of hob or cutter used today in milling spiral gears* are, strictly speaking, *not correct*. Nevertheless the work produced is accepted everywhere as satisfactory and proves in fact quite satisfactory for ordinary speeds; but that is due to the overwhelming inherent advantages of the spiral type over the straight spur type of gear. Were such work produced on spur gears the results would prove disastrous.

A strange condition exists at present regarding this question. When a spur gear is to be cut nothing is too good for it, the nearest obtainable size of cutter is selected, and for particular work special cutters are made. When the milling operation is terminated the gear is put in place and set to work. For spiral gears it is another story. In the first place, the nearest size *equivalent* spur cutter is selected, and the helix angles are modified to suit it if necessary. After the milling operation, scraping or generous grinding is in order, and the teeth are wrong anyway.

The proper way is evidently, considering the spiral gear as a twisted spur, to delineate at a suitable scale the profile of the tooth space as viewed on a plane normal to the axis, and then to reverse the process illustrated by Figs. 4, 5 and 6, that is, given the correct profile of the tooth required, to determine by elementary geometrical process the profile of the cutter that should be used.

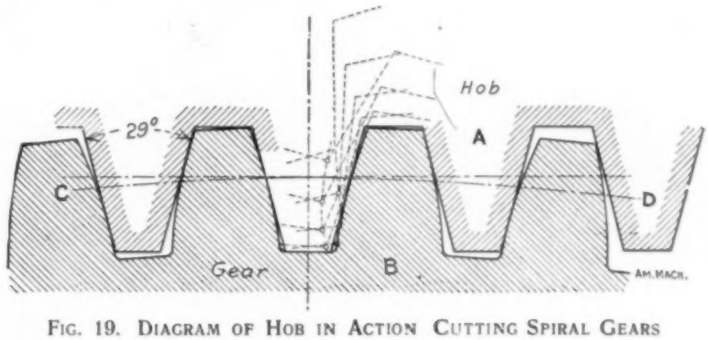


Fig. 19. Diagram of Hob in Action Cutting Spiral Gears

This method is entirely satisfactory for the end mill, provided, however, that the various diameters of the mill be made not to suit the intersections of the normal *m n* with the helices of the different points of the hight of the tooth, but instead, be made tangent to the said helices. There is a small difference between the two ways; for large work it must not be overlooked.

While it is generally recognized that end milling is the ideal method for this kind of work, it has not received in this country the same favor it enjoys in Europe. Effectively there are grave objections to it. The mill is bound to wear rapidly and consequently to lose its originally correct shape. Then there are questions of the material of the mill, its temper, its lubrication, its speed of rotation, the slowness of the operation, etc. Perhaps the most satisfactory way to proceed would be to rough cut the gear by hobbing and to finish it with an end mill. For manufacturing gears the use of Pratt

& Whitney's pantagraphic machine for forming cutters would prove highly beneficial. With such a machine end mills could be formed very cheaply and quickly reground whenever needed. This would remove some of the objections mentioned above.

The single-tooth cutter method, like end milling, has many disadvantages, but it is to be recommended for pinion work in preference to hobbing, because, with the cutter, there is less interference to be feared. For large gear work it is unusual to cut the teeth consecutively with the same cutter. Instead, one space is cut first, like *A B*, Fig. 18, then another, like *C D* which starts well inside the projection *A E* of *A B*. The third cut bears the same relativity to the second, and so on until one complete turn has been made. Then the first cut of a new series is begun inside of space *A C* and the work is continued in the same manner as for the first series, and so on until all the teeth are formed. It may then be found necessary to take one light finishing cut all around, but this does not necessitate the same precautions as before, although for very fine work the same rule might be found to give better results. The idea involved is that better transition is insured when a tooth like *C D* takes hold before one like *A B* leaves off, the difference between them, due to the wear of the cutter, being extremely small and certainly far less than that between one of these and one of the rest.

The main objection to the single-tooth cutter is the slowness of operation. To offset this a number of cutters, each of proper form, may be set to work together; but great care must be exercised in making the cutters and in locating them with respect to the work.

Hobbing

Hobbing is by far the quickest process, but the teeth produced are bound to be wrongly shaped unless the hob itself is specially designed for the work. In Fig. 19, *A* is a section of the hob in contact at the pitch line with a section *B* of the gear. With a 14½-degree pressure angle the hob angle is 29 degrees. In this figure the pitch diameter of the gear is precisely the same as that of Fig. 4, that is, twice the minor axis of the ellipse formed by the plane *m n*. The pitch of the hob is the normal pitch of the gear. By rolling the hob on the pitch line *C D* the teeth of the gear are formed, as shown, and they have precisely the same profile as obtained in Fig. 4. Consequently, while these teeth are correct with respect to the normal pitch basis, they would turn out to be just as wrong as those of Fig. 6, with respect to the circular pitch action, and they would have the same irregularity of contact as found in Figs. 7 to 12, inclusive.

The flanks of the hob tooth should not be straight, they should be profiled to the shape required for producing finally the correct gear-tooth form as seen on a plane normal to the axis.

It may be objected right here that much work is necessary to produce such *refinement;* that the returns expected do not seem to warrant the expenditure, and that, to insist upon the work being *so perfect* looks more like a craving for mathematical precision than the proper recognition of practical, every-day, machine requirements.

To this I may reply that, in the first place, the tooth action should be correct; then, the work necessary to accomplish this, while refined, is certainly within the means of the gear maker; and finally, it can easily be proved that a saving of time and money may be realized at once by following the right method. Thus, we have studied two pinions, one transmitting 150 horsepower to one gear, with a pressure of about 23 pounds per lineal inch of contact, the other transmitting 1200 horsepower to one gear with 161 pounds per inch of contact. There is no earthly reason preventing the use of the same rate of pressure for both since these gears are intended to work under precisely similar conditions, and expected to last one as long as the other. Now, with a correct shape of tooth provided for the smaller machine, the length of its gear could be reduced quite materially. The total length of the two parts of the pinion is, as we have seen, $9\frac{1}{2} \times 2 = 19$ inches, then, the actually required length is $\frac{19 \times 23}{161} = 2.72$ inches. Therefore it would be safe to make the total length 3 inches; in this way the two pinions considered would now work on practically an equal basis. What is the immediate result? The cost of the gears for the small machine would be 3/19 of the original; they would be correct; the pinion shaft would be exceedingly rigid, since the distance between bearings would be 16 inches less than it was before, and, as we know, the deflection of a shaft is a function of the cube of its length between supports. There would be economy realized on the weight and bulk of the gear casing, of the bedplate and of the machine as a whole.

Hobbing Machines

The usual type of hobbing machine is schematically shown in Fig. 20. The gear blank is centered on a mandrel and adjusted rigidly on the support *A*, which is bolted to the driving gear. This wheel is itself driven by a worm accurately positioned by the sliding bracket *B*. The hob receives its movement through bevel gearing, not shown here, contained in the cutter head *C*. This movement as well as that of the driving worm are derived through suitable gearing from the main driving shaft of the machine. The feed is provided by a vertical displacement of the cutter head, and through the guided and adjustable slide block *D*, a simultaneous lateral movement is communicated to the sliding bracket *B*, thus causing the driving wheel to be rotated both by rack as well as by worm action. The feed motion is, of course, also derived, through gearing, from that of the main shaft. The machine is thus working automatically. The adjustable slide *D* is very useful in that it permits to take care of small irregularities in the angular position of the hob, but otherwise it could easily be replaced by a direct screw feed.

Fig. 20 is somewhat misleading in that it shows the gear blank mounted on a mandrel; the right way is to fix definitely the gear body on its own shaft, and then make provision for centering this assemblage carefully, and to connect it rigidly to the driving wheel. Otherwise, were the wheel cut separately it would most likely be forced out of true when adjusted onto its shaft.

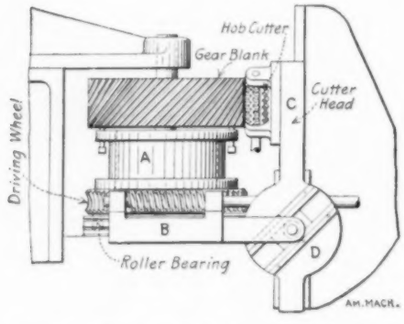


Fig. 20. Diagram of Hobbing Machine

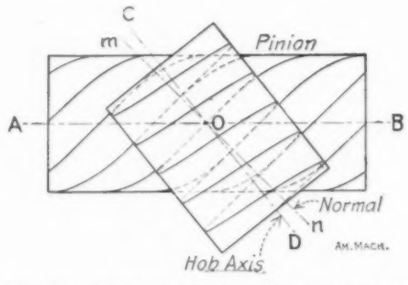


Fig. 21. Left-hand Hob Set to Cut a Spiral Gear

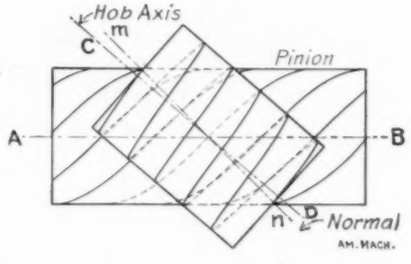


Fig. 22. Right-hand Hob Set to Cut a Spiral Gear

It should never be overlooked that machine tools and particularly the hobbing machine may appear ridiculously too strong, and yet be barely rigid enough to suit the work intended. Extreme rigidity should be the keynote of the design; next comes extreme simplicity in transmission of movement, this involves using the fewest parts; back-lash should be reduced to the very minimum consistent with freedom of moving parts; there should be a copiously lubricated friction brake on the hob stem itself, and it is advantageous to use a friction shoe on the top of the gear blank.

In this article we have taken it for granted that the hob axis coincides precisely with the normal *m n;* as a matter of fact it crosses it on one side or on the other according to whether the hob is right-handed or left-handed. Thus in Fig. 21, a left-handed hob meshes with a left-handed gear, and the helices being made to coincide at point *o*, we see that angle *A o C* is greater than *A o M*. We remark also that the curvature of the hob helix is the reverse of that of the gear helix. While this fact should not preclude the use of this hob, nevertheless a right-hand one would be preferable since its helix has the same curvature direction as that of the gear thread. This is shown in Fig. 22, where also, angle *A o C* is now smaller than *A o M*. We should conclude from this that the hob should be designed to suit its angle of coincidence *A o C*, Fig. 22, which determines the actual location of the tool with respect to the work on the hobbing machine.

The hob is much easier to make and to keep true when the pitch helix angle of the gear is not steep. The 45-degree angle is too steep, and one between 20 and 30 degrees will be found far more suitable, for the benefits of the twist obtain to a marked degree even with a very small angle.

Lubrication

High-speed gearing requires special attention as regards lubrication. There should always be a film of oil between the surfaces when contact takes place, otherwise these surfaces would soon be abraded. Lubricating tubes should be led, wedge-shaped at the end, as close as possible to the line of junction of the wto gears in action, and the feed should be continuous. It is almost unnecessary to say that the tubes should be firmly secured so that vibrations would not set in and throw them against the gears, with a disastrous result. Gravity feed from a good-sized tank placed some 10 to 15 feet above the gears is good practice. The oil should be withdrawn from the gear casing and thence pumped to a filter delivering into the feed tank. Under no circumstance should the gears be allowed to run in a bath of oil, for, in addition to thus providing a liquid brake, or power absorber, the rotation proper and the windage of the gears would soon atomize the greater part of the oil, which would then come out of the casing through the joints or other openings.

The effect of windage on the jets of oil issuing from the feed tubes should also be studied, as in a number of instances, windage, by deviating the flow of oil, is known to have caused the wreckage of gears.

Efficiency

Helical gearing seems to possess great efficiency; thus for the 6000-horsepower Westinghouse machine an efficiency of 98½ per cent. has been actually recorded. On the strength of that some gear makers have claimed an even higher figure, but such statements lack the confirmative proof of an authentic test, and the user, if at all interested in the matter should demand the proof. The use of helical gearing is becoming so extensive that engineers are greatly interested both technically and practically in the possibilities of such a valuable auxiliary, and would welcome the publication of reliable, carefully made tests, and also of data concerning the behavior and life of the gears.

A Pulley and Gear Blank Polishing Machine

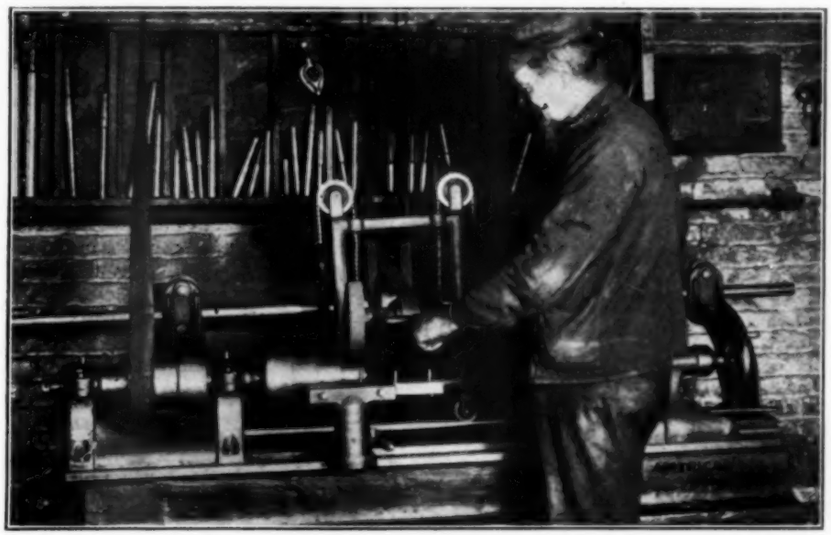
Editorial Correspondence

The Rockford Drilling Machine Company, Rockford, Ill., has a polishing machine in its shop, which is used for polishing pulleys, cone pulleys, gear blanks and practically all parts that can be rotated.

This machine is shown in the accompanying halftone and consists of a speed lathe to which has been added the polishing attachment shown. The shaft *A*, carrying the driving pulley, runs between hollow rollers in the brackets *B* and *C*, which gives a very easy movement to the polishing head. A bar *D* acts as a track for the upright frame used to steady the polishing head, which is counterbalanced by means of chains and springs and which has a swinging joint, so that a tilting movement may be given to the polishing wheel when necessary to polish the edges of cones, the ends of collars or the under surfaces of gear blanks.

Generally the work is carried on the headstock only and revolves at a slow rate of speed, while the polishing wheel runs at a suitable speed in the opposite direction.

Two handles at right angles to each other are provided on the end of the polishing head, so that the operator can easily control or move the device into any desired position.



A Pulley and Gear Blank Polishing Machine

A very practical effort to prevent misunderstanding in ordering repairs and in spreading information as to the names of parts of machinery, is being used by the Murray Iron Works, Burlington, Iowa. This is known as, "Nomenclature of Murray Corliss Engines" and is No. 7 of a series of pamphlets issued by them. It is clearly, but inexpensively worked out and it might be well if more of this kind of work were done.

The best way to bore a car wheel is to take a light finished cut independent of roughing cutters. This is a point well understood in machine work, but, strange to say, for wheel work the scheme of rough and finished boring all at one time is advocated principally on account of greater output of machines; while it is true that many wheels are bored very satisfactorily by this method, it is on the whole undesirable on account of stray wheels going into service having ridges in the bore.

German National Technical Museum

By Paul Kreuzpointner*

A brief sketch of the broad principles underlying industrial and economic advancement.

The aims and objects of the German Museum for Technical Masterworks and of Natural Sciences.

*Chairman, committee on industrial education, American Foundrymen's Association.

In its broadest sense technic is concerned with the practical application of physical laws in the mechanics arts.

Natural science is the comprehensive, systematic knowledge of the laws of nature and principles underlying the application of physics to the pursuit of the mechanics arts.

Technical knowledge, that is the application of physics for purely practical and useful purposes, served as a guide in the mechanic arts long before the systematic application of the underlying scientific principles, because experience had taught the engineer and mechanic to do things in a certain way before the reason why was understood.

In other words the study of the laws of nature, that is of the natural sciences, did not keep pace with the necessity to apply these laws in everyday practice. The savage who was the first to tie his stone ax to a handle in order to get more work out of it than by holding the ax in his fist, was the first engineer. Intuitively he used technical knowledge to apply a scientific principle without in the least understanding the law governing the principle. The Romans were good metallurgists and their superiority in this branch of technical knowledge and the mechanic arts gave them a great advantage over the nations and tribes which were brought under Roman subjection and whose technical knowledge was inferior to that of the Romans.

But the Romans had only a limited understanding of the use of wind and water power. Hence, when their advancing civilization required the production of more and better iron and steel and they did not know how to increase the capacity of their little blast furnaces, they went in search of and to conquer such countries as promised a supply of superior iron ores. Today, modern nations go in search of raw materials and of markets to keep their industries active and their people prosperous. Thus, economic law operated the same two thousand years ago as it operates today.

A country, rich in natural resources, and able to waste these resources during the practical application of technical knowledge in the struggle for existence, but the people of which are, in the majority, not possessed of a knowledge of the underlying scientific principles, will, sooner or later, find itself in an economic condition which compels the more general diffusion of a knowledge of scientific principles.

Even in a country with, apparently, inexhaustible resources, there will come a time when these resources begin to diminish in quantity or quality, or both. Then the time has arrived when the technical knowledge must be supplemented by the study of natural sciences and underlying principles. Germany, being poor in natural resources, has always been noted for her scientific education and philosophic researches, and in founding the German Museum for Technical Masterworks and of Natural Science it was the aim and purpose not only to emphasize the importance of technical knowledge at a time when the technical engineer occupies a position in the front rank of social and economic forces, but also to present, not only to the German people but to the whole technical world, a concise review of the development and the slow progress of the practical application of technical knowledge and the fruits, as it were, of the successive study of the natural sciences. It is the grand conception of the museum to stimulate the practical application of scientifically directed technical knowledge.

The German Museum was founded June 28, 1903, and the following excerpts from the opening speeches are expressive of the aim and purpose of the museum.

His Royal Highness, Prince Louis of Bavaria, opened the meeting with the following remarks:

"Technic is nothing else but applied physics and physics is nothing else but natural science. The difference consists in physics teaching us the theory of the forces of nature and their application and technic shows us how to make practical use of the theoretical knowledge."

"The object then of this association is to gather into one vast museum technical masterworks of applied natural science, not only of the present but also of the past. Likewise all the available documents having a bearing upon these masterworks, and portraits of distinguished engineers and scientists. Looking about us in the world we live in, we find that in those countries where science and technic have made the greatest progress, not only is population greater, but what is more, the people of those countries enjoy greater physical well being. Therefore, may this museum not only be a source of pride to this city but also be a source of public welfare for our beloved country, for the German Empire, and not less so for all mankind."

In concluding the formality of acceptance the Executive Committee of the German Museum remarked:

"It was the opinion of the committee that the best use of such a museum is to illustrate the influences of scientific research upon technical knowledge and to show at the same time the historic development of the various branches of industries by means of typical products, the cultural and economic value of which has been universally approved."

His Excellency the Minister of the Royal Household and of the State, Freiherr von Podewils said:

"While art is a means for the cultivation of a more esthetic and nobler life, so technical knowledge and the natural sciences illuminate the pathway toward a progressive and refined existence, shortening distances beyond all barriers and bringing the activity of distant minds to our immediate knowledge. In our days technic and science progress with bewildering rapidity But progress demands retrospect. We cannot add links to the golden chain without intimately understanding the details of its construction. And what the word is not able to make clear to us we impress upon our minds by means of visual objects."

General Director Dr.-Ing. von Oechelhaeuser spoke on behalf of the Society of German Engineers:

"The Society of German Engineers welcomes with particular pleasure the creation of this museum. On first thought it may seem strange to the modern engineer to direct his attention backward, when, during the last few decades, he was obliged to look forward with such intensity that he had hardly time to grasp the present fully and digest the technical literature, much less to interest himself in the relics of the past.

"However, just as it is necessary for an individual to look backward after reaching a certain hight in order to locate himself and arrange the results of his achievements in order that he may proceed with renewed assurance and certainty of aim, so likewise is this a necessity for the engineers, collectively."

The Director of the Royal Technical High School made the following remarks:

"In the museum typical examples will give us object lessons how great discoveries in technics and natural science had had their origin in small beginnings; how they were developed amid difficulties and patient, self sacrificing work. How a happy idea, a spontaneous intuition helped to complete the work which again led to new problems, to new suc-

cesses. On the other hand they illustrate how often side issues unexpectedly contribute to the solution of a problem when the time is ripe."

By the Director of the Bavarian Industrial Museum in Nuremburg:

"Could we, today, measure properly and justly the standard of culture of a people or nation if we leave out of consideration the achievements of that nation in the realm of technics? Are not, in the history of nations, the visible products of their technical knowledge a reliable, nay, often the only available measure of gaging the degree of their higher or lower standard, of their culture?"

The last of the speakers was Geheimer Regierungsrat Professor Rietschel, of Berlin, who said:

"The museum will be the corner stone of the scientific history of technical knowledge. The museum will make it possible to teach in our universities the history of technic within the logical limits of its various stages of development. The museum will be a means to teach the general public that the achievements of technical science are not serving material interests only as is now the almost universal belief, but is a powerful agency for the promotion of cultural life."

Typical German Thoroughness

In order to interest all classes of society in the general aim of the museum, at home and abroad, an association was formed for the promotion of the undertaking. There was a membership of 2500 on January 1, 1910. There is no definite or fixed, membership fee, or dues, though the minimum contribution is limited to two dollars.

A new building is being erected at a cost of ten million marks ($2,500,000) and meanwhile the collections are housed in temporary quarters. The following donations have been received toward the new building: From the empire of Germany, 2,000,000 marks; from the Kingdom of Bavaria, 2,000,000; from the municipality of Munich, 1,000,000; from all other sources, 2,061,690; making a total of 7,061,690 marks, or in round numbers about $1,745,000.

The railroads of Germany have agreed to transport all building material free of any charge and the city of Munich has given the ground upon which the building is to be erected. German manufacturers in all lines of building material have made large contributions, and in such instances where they have made any charge at all it has been practically at cost price. The present regular annual contributions are as follows: From the German empire, 50,000 marks; from the kingdom of Bavaria, 50,000; from the municipality of Munich, 15,000; from all other sources, 71,773; making a total of 186,773 marks, or about $46,600.

Scope of Museum

In conformity with the statutes:

"The German museum aims, as a Museum for Technical Masterworks and Natural Science, to illustrate the historic development of the researches in the natural sciences, of technical knowledge and of the industries in their manifold relations and connections. To show, by means of typical masterpieces, the most important steps in that development. It is a national institution, designed to serve as an encouraging example for all the German people." For the purpose of carrying out this aim there are provided:

1. Collections of scientific instruments and apparatus. Specimen of celebrated mechanic-technical productions in their originals or in models, so arranged and illustrated as to make them highly instructive and educational. New specimens are constantly being added to the collections.

2. There is likewise provided a library, containing valuable documents of a scientific and technical nature, manuscripts, drawings and printed matter.

3. Representative works of modern scientific literature, publications, lectures, etc. Busts and portraits of celebrated inventors who rendered distinguished service to mankind.

Administrative Details

The board of directors shall consist of not less than 50 nor more than 100 members, to be selected in the following manner: Three members each to be appointed by the German Chancellor, the Prussian government and the Bavarian government, and two members each by the government of Saxony, Würtemberg, Baden and Hesse, and one each by all the other German governments.

The German chancellor shall select four members from various state departments. Different societies and associations, covering all branches of the arts and sciences, shall select one member each, and the executive committee is empowered to select additional members.

Composition of the Executive Committee

The honorary members of the German museum.

The three directors.

The legal advisor of the museum.

The members of the provisional committee in charge of organizing the museum.

Friends of the museum who contribute not less than 5000 marks ($1250).

Sources of Income

1. The annual contributions by the German and Bavarian governments.

2. Membership dues, donations, regular annual contributions from governments, municipalities, corporations, societies, associations or individuals.

3. From interest on investments.

4. From admission fees and the sale of catalogs or other printed matter.

The number of visitors to the museum has steadily increased, as shown:

Attendance

1906-1907	196,500
1907-1908	270,600
1908-1909	284,200
1909-1910	313,000

The highest attendance during any one month was in August, 1910, when 44,900 persons visited the museum.

The museum is open to visitors 69 hours during the week, including Sunday afternoon.

Average number of visitors:

Sunday afternoons	1470
Mondays	740
Tuesdays	360
Wednesdays	750
Thursdays	800
Fridays	490
Saturdays	820

Explanatory Lectures and Guidance

At irregular intervals lectures, pertaining to the collections, will be delivered either in the various exhibition rooms, or in the auditorium of the library.

The admissable number of persons at these lectures may vary from 30 to 120, depending upon the locality where the lecture is to be held.

The admission fee to these lectures will be announced at the time.

Guidance of Groups of Visitors by Engineers

Guidance of groups by engineers takes place Mondays, Wednesdays and Fridays, at 8.15 p.m.

The number of persons in a group is from 30 to 40.

The entrance fee is 40 pfennigs (10 cents); for members, 20 pfennigs (5 cents). The program for such guided tours will be published one month in advance.

Special Guidance for Individuals or Groups

Upon notice and by obtaining the necessary tickets, special guidance can be secured between 9 and 11 a.m., and 2.30 and 7 p.m.

Two hours is the duration of a special trip.

The price for a special guide, exclusive of the regular admission fee, is 6 marks, about $1.50, for one to three persons. For every additional person, 1 mark (about 25 cents).

The publications include lectures, addresses, biographies of celebrated scientists or technical men and reports.

All publications are furnished to members for half price.

The collections embrace all of the arts, sciences and industries of the world, and are illustrated by working models, pictures, and actual experiments and tests.

Many of the models give a sectional view of the machine, building, structure, device, mine or ship, in order to illustrate or emphasize the value of the invention or scientific principle.

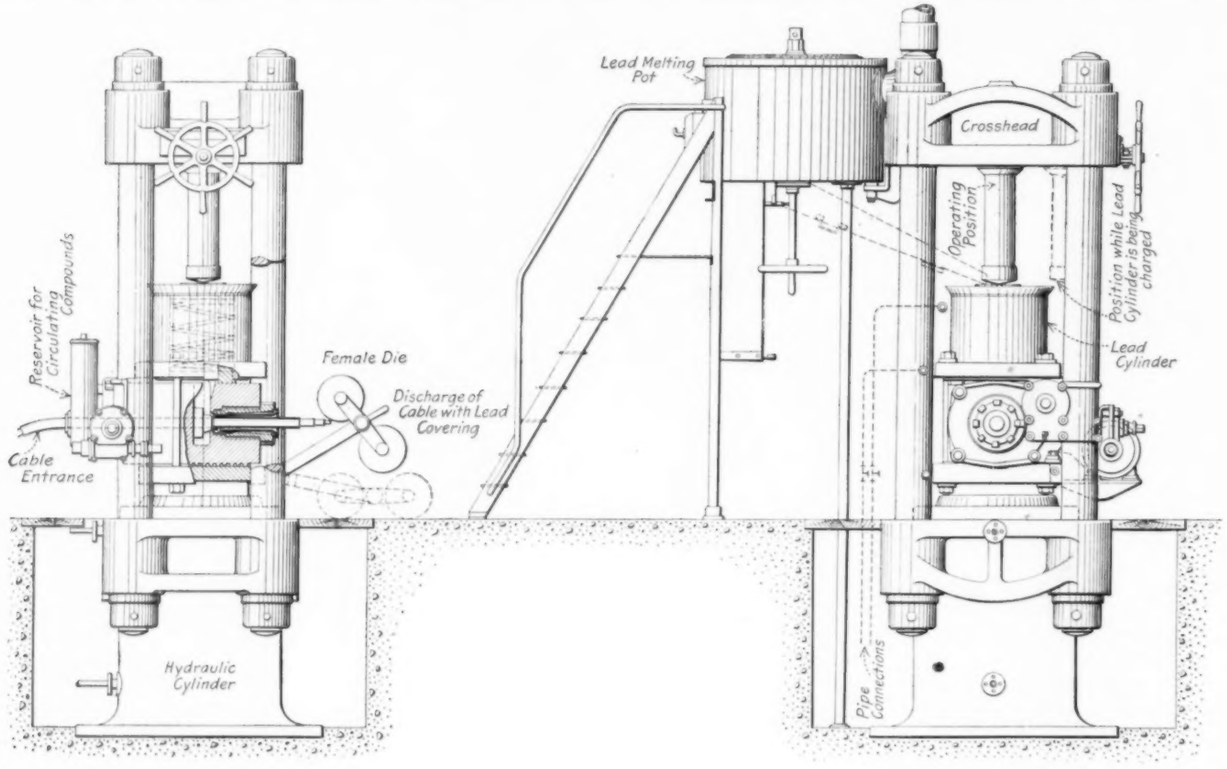
Press in Making Lead-covered Cable

By F. H. Gottlieb

A type of the most highly developed of these covers electric cable with a uniform thickness of lead free from oxide, and is so simple in its operation that it requires no skilled labor.

The rapid development of the electrical industry and the great increase in the number of high-tension circuits, even as early as 1870, demanded conducting material in greater diameters and lengths. Hence, there was created a necessity for apparatus with which insulated wires, up to the largest cable diameters, could be covered with lead.

The Siemens lead-cable press was one of the first successful machines to be developed for this purpose. The cable is inserted from below in a hollow-steel core bar, passing through the center of the machine and, by means of a pair of dies, is covered with a lead pipe formed from a *cold* lead cylinder by compression.

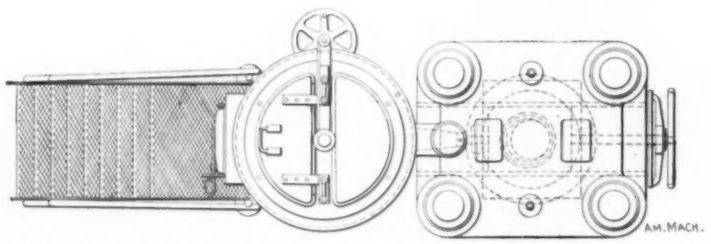


By means of the Siemens press, a faultless lead mantle, free from oxide, can be produced.

Its advantages, however, are offset by certain disadvantages. As soon as one charge in the lead receiver is worked up, the press must be stopped to supply a new lead cylinder. On account of its great hight, the operation of the press is difficult; furthermore, its operation requires trained hands.

Another press, which was taken up especially in Switzerland and south Germany, is the one designed by Berthoud & Borel. This press is in certain arrangements similar to the Siemens press.

The cable, however, enters at the top and leaves at the bottom. As in the Siemens press, the receiver was at first charged with a cold lead cylinder, but later this method was changed, and molten lead was poured into an opening at the top of the lead receiver. However, charging with molten lead could not guarantee the production of a lead pipe free from oxide.



WEISS LEAD CABLE PRESS

The Huber press is of the horizontal type. This arrangement conducts the lead to the dies from both sides instead of one, which necessitates that one lead receiver and one hydraulic cylinder with their pistons be placed on each side of the die chamber. These presses have given good results. However, they can be worked only by experienced hands.

The Weiss press, one of the most successful now on the market, is illustrated in the accompanying figure. This press is of the vertical type. The lower part of the hydraulic cylinder is also the base of the press, while the upper part receives strong columns to the end of which the head is screwed to complete the hydraulic frame. The hydraulic cylinder is lined with a strong bronze bushing. The hydraulic piston is moved up and down by pressure water and packed by a multiple arrangement of leather collars. The die chamber and the lead receiver are placed on the top of the hydraulic piston, as shown in the illustration. The die chamber is made out of a single piece of fine steel and the inner channels are so arranged that the dies receive the lead in such a manner that a faultless lead pipe, of even thickness of metal,

without seam, and absolutely concentric, is produced.

The male die, as well as the female die, is screwed in the die chamber by a strong hollow spindle, in such a way that both stand concentric with each other. Through the expansion of the masses of the block and other parts, as well as the movement in the screw joints, the dies are often shifted out of their common axis. In order to correct these displacements, the female die is arranged in such a way, that it can be adjusted during the operation of the press. This adjustment is effected by setscrews in the head of the screw joint, which act on a hollow cylinder with a neck. This cylinder acts as a transmitting lever, whereby its end effects the movement of the female die at right angles to its axis. On the farther end of the screw joint, the adjusting cylinder is so arranged that the position of the female die inside of the die chamber is visible outside. While the uniformity in thickness of the lead pipe is controlled by the female die, the thickness itself is regulated by the axial position of the male die.

The adjustments of the dies that are carried out while the press is charged with lead, require a large power. Therefore, the head of the screw joint is fitted with a strong set of gear wheels driven by a 4-h.p. electric motor. Such regulations can be carried out in a short time. This adjusting arrangement can also be effected by a handwheel.

The lead receiver consists of an inner cylinder over which an outer steel shell with a flange is shrunk. Within this shell, the steam-heating channels are inclosed, as shown in the figure. The lead receiver is funnel-shaped at its upper end and surrounded by a detachable ring-shaped receptacle which catches the overflowing lead and from which the latter can easily be removed.

The lead piston hangs in a frame by which it can be moved aside after having been freed by the downward stroke of the receiver, to permit filling the receiver with molten lead. This sliding frame of the lead piston is of such a construction that it can be adjusted to its exact axial position to correct a displacement caused by a distortion of the press frame. In this way a one-sided rubbing of the piston on the cylinder wall is excluded. The lead piston itself is lined with phosphor-bronze at its lower end. The lead piston is moved in the sliding frame attached to the lower part of the press head by a screw spindle with a handwheel. This movement is adjustable by a set screw.

Attached to the press head is the lead-melting pot, of parabolic shape and made of cast steel, with covers and a discharge valve, which is operated by a handwheel from below. The melting pot can be heated with gas, petroleum or coal.

The warming of the cold press to the working temperature is done by a steam-heating arrangement, located below the die block and the steam channels in the lead receiver before described. This same steam-heating arrangement acts also as a cooling medium, if the receiver after repeated charging with molten lead has been overheated. The lead receiver in being charged is filled with lead to overflowing, and the oxide floating on top is scraped off; then the piston is brought down into the cylinder as quickly as possible. The piston is held under medium pressure in the cylinder for five to ten minutes, until solidification of the lead has taken place, after which the process of pressing begins.

It is of great importance that the cables impregnated with an insulating compound fill the lead mantle which they receive in the press in its entirety and without air bubbles. For this purpose, a tank containing an insulating compound, is attached to the Weiss press, through which the cable passes on its way to the dies. In this way, the passing cable is kept constantly entirely covered by the impregnating compound. If in delivering from the drum, the freshly impregnated cable has become porous, or dents have been formed on it, these are all filled in passing through the receiver. If, on the other hand, the cable has received too much of the compound, this is scraped off when the cable is entering the newly developed lead pipe.

After the cable has received an even covering of the desired thickness by passing through the lead dies, it is carried over guide pulleys to a winding arrangement.

The handling of the Weiss press is extremely simple, and no trained or intelligent hands are required. On account of its vertical arrangement, it requires very little floor space. All parts are very easily accessible. The lead covering produced is absolutely free from oxide, and the thickness of the lead metal is uniform. As interruptions in operation are almost excluded, the Weiss press is very economical, and has an excellent capacity.

An Excellent Endowment

By H. A. Peters

The employees of the Bement-Miles Company, Philadelphia, have an endowment fund which pays to the family of a member, $100 at his death and sends $5 worth of flowers. This fund must be at least $300 and not more than $500. To start it every member was charged 25 cents and 5 cents weekly until the $500 was made up, which the treasurer turned into the company, the fund receiving 2 per cent. interest. When a member dies, reducing the fund to $400, there is no charge, but at the next death, which reduces the fund to $300, an assessment of 25 cents is made and 5 cents a week dues collected until the fund again reaches $500.

The only officer who receives pay for his services is the secretary. A man coming into the shop may join for 25 cents, if in apparent good health, and on leaving may retain his membership.

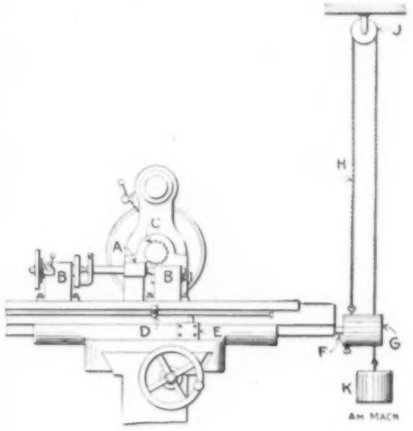
I have been a member since its inception, 10 years ago, and to date have paid a grand total of $6.65 in dues and assessments. The total number of deaths I am unaware of, but in the past year there were six. This fund was the means of providing a suitable burial for several very poor laboring men.

Quick Return for Miller Table

By E. W. Tate

Having a large amount of spindles to cut on a miller, we found it took a great deal of time to bring the table into position for the next cut. To overcome this, our foreman of the milling department devised the arrangement illustrated by the accompanying figure.

A is the pinion to be cut, *B* represents the head- and foot-stock of the dividing head. *C* is the milling cutter. *D* is the adjustable knock-off pin. *E* is the feed-trip



Miller Table with Quick Return

plunger. *F* is a screw used for the feeding table. *G* is the roll to which the cable *H* is secured by means of an eye-bolt. *T* is a sheave attached to the ceiling. *K* is a weight.

The roll *G* is fastened to the screw *F* by means of a setscrew. The feed is thrown in, and as screw *F* rotates, causing roll to do likewise, cable *H* is wound around roll *G*, lifting weight *K*.

At the end of the cut, pin *D* comes in contact with the plunger *E*, and throws the feed out of mesh; the weight descends and causes the screw *F* to rotate in the opposite direction, thus bringing the table and work back to the starting point.

The dividing head is indexed and the operation is repeated. This device has proved a great time-saver in our shop, as the operator was able to attend to other work in an adjacent machine.

Building Blowers and Rotary Pumps

The Connersville Blower Company, Connersville, Indiana, manufactures pressure blowers and rotary pumps for various purposes and in these machines two types of impellers with accurately produced curves are used, the curve in one instance being of involute form and in the other cycloidal. The impellers of either type are interesting machine-shop products and the operations, especially upon the larger sizes, are of an unusual nature.

The impellers in some machines range up to 8 feet or more in length, with lobes correspondingly large, and the problem of machining such castings to the correct form and dimensions presents some peculiar difficulties.

Editorial Correspondence

Unusual operations employed for finishing peculiarly shaped castings used as impellers in pressure blowers and in cycloidal pumps.

Planing to a templet; boring head plates and cylinders; facing in planer and lathe.

Milling operations on small apparatus.

Types of Impeller Lobes

In Fig. 1 a large pressure blower is represented on the erecting floor with the machine in place upon its bed plate, but with the upper half of the casing or cylinder removed in order to show the form of the impellers. Fig. 2, which is a cross-section through a blower of this type, illustrates the involute form of impeller and shows how the lobes are designed to revolve together without waste space or pockets between them. At the same time attention is called to the fact that these impellers are so machined that in operation they never actually contact with each other or with the wall of the cylinder, allowance being made for a slight but uniform amount of clearance at all points between the working faces of the lobes and between the ends of the lobes and the casing.

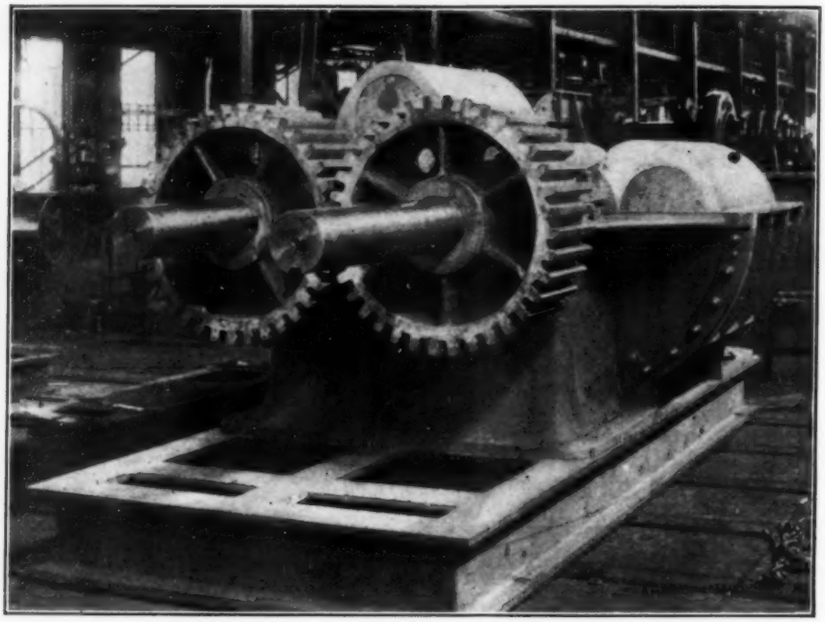


Fig. 1. Large Pressure Blower in Process of Erection

Fig. 3 is a cross-section through a rotary pump and with impellers of the cycloidal form and adapted to the pumping of liquids of all kinds.

Where the involute impeller machines are constructed as gas blowers and gas exhausters the impeller lobes are formed with a slight lip at the extreme ends to keep the casing free from deposit due to the nature of the substance passed through the blower.

Machining Impellers

The operations on impellers include boring the casting to receive the main shaft; counterboring, drilling and tapping for the heads; facing the ends; planing the lobes to a templet. The method of facing the ends is represented by Figs. 4 and 5. After the boring operations in the horizontal machine the casting is placed between two angle plates on the planer platen, and the greater portion of the surplus stock removed with tools in the side heads. The finishing of the ends is accomplished in the lathe with the impeller mounted on an arbor between centers, as illustrated in Fig. 5, which shows a smaller size of impeller than is seen on the planer in Fig. 4. The process is the same, however, for all sizes.

The Application of the Templet

The planing of the lobes to the desired curve is accomplished by the aid of a templet which is mounted on the shaft

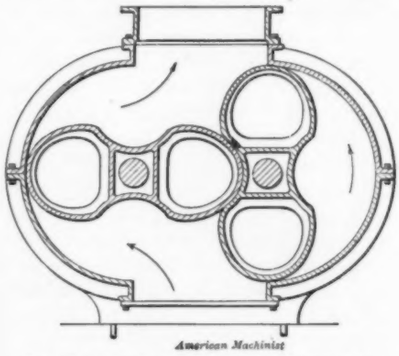


Fig. 2. Involute Form of Impeller

with the impeller. As the templet is located at the forward end of the work it cannot be seen in the engraving, Fig. 6. It is of cast iron and about 1½ inches thick. In the view the workman is seen setting the finishing tool to the templet.

The impeller casting is supported between two big angle plates with V's in each face of the plates so that they may

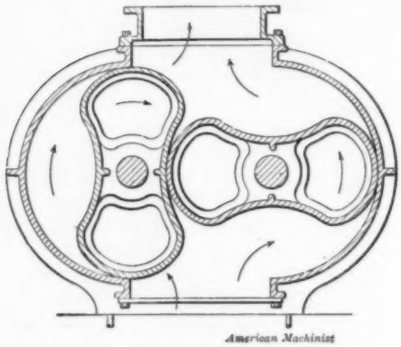


Fig. 3. Rotary Pump with Cycloidal Impellers

be set on either surface to suit different sizes of impellers. Two cuts are taken over the casting and in the finishing operation tools are used which closely approximate the curvature required on the work. This allows fairly broad scraping cuts to be taken to give the smooth surface desired.

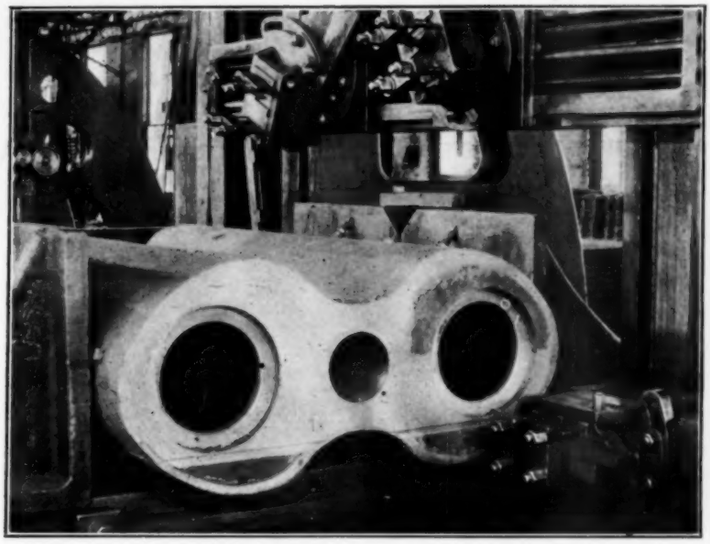


FIG. 4. PLANING THE END OF AN IMPELLER

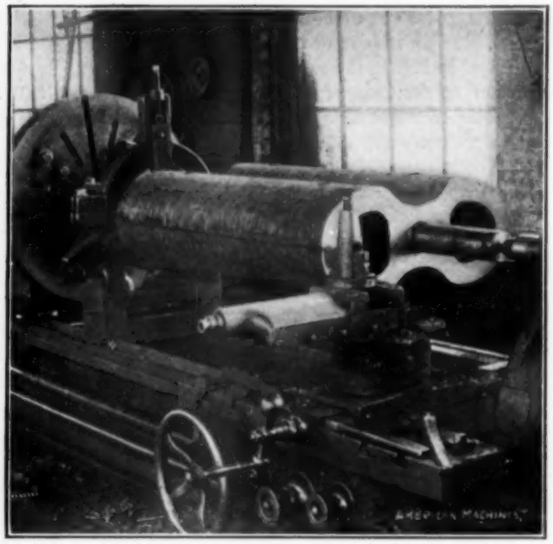


FIG. 5. FINISHING AN IMPELLER END ON THE LATHE

A TOOL ROOM VIEW

The character of the templets is shown by Fig. 7, which is a view in the tool room with several templets in the foreground and under the bench. The geared appliance to the right is a fixture used in making and testing such templets. It consists of a plate with two studs mounted at the proper center distances for the gears for a certain size of impeller, and over the gears the two templets under construction are placed and rotated to see if their lobes are correctly formed and match properly when revolved by the gearing.

The templets are originally laid out to the theoretically correct curve, and then the plates are milled as closely to the line as feasible and finally finished by hand exactly to the line.

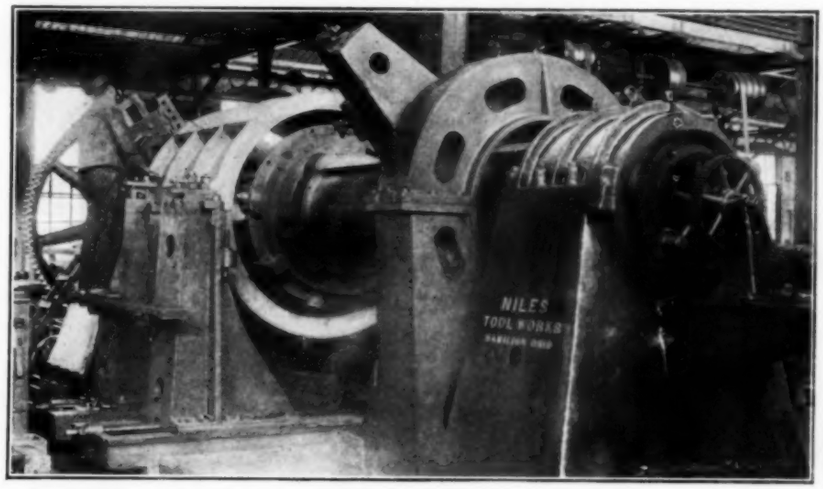


FIG. 8. BORING A BLOWER CYLINDER

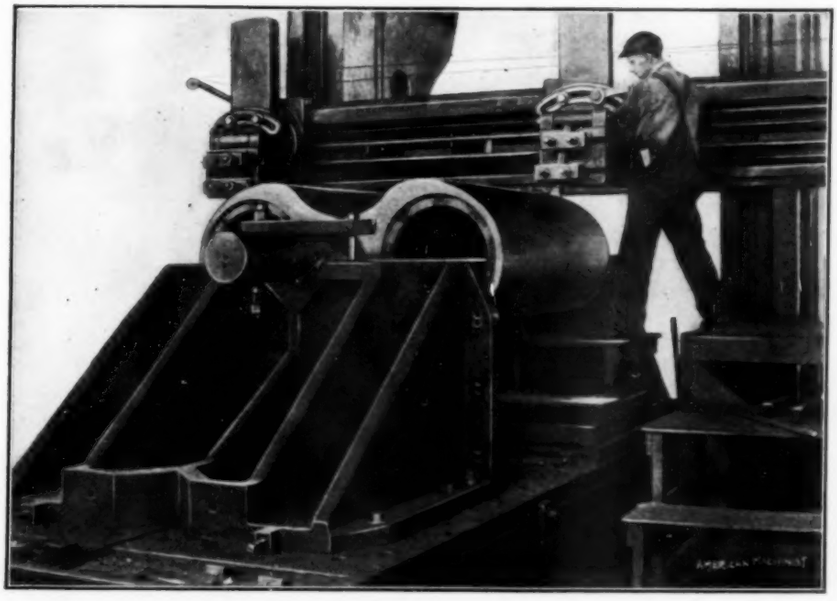


FIG. 6. PLANING IMPELLER LOBES TO A TEMPLET

Some of the impellers are made with three lobes, more particularly in the smaller sizes, and several three-lobe templets are included in the group in Fig. 7.

SYSTEM OF GAGES

In connection with this illustration of the tool room attention may be called to the system of shop gages mounted on the wall and carried in the blocks on the bench. A Brown & Sharpe 8-foot vernier is shown on the bench in front of the gages and this tool is used as a bench measuring machine for testing all gages. It is, of course, ordinarily covered with a case to protect it from injury.

At the top of the photograph will be noticed an 8-foot micrometer with pressed-steel frame.

The sizes of the different gages are stenciled in conspicuous characters on the wall immediately under each tool so that any gage can be located instantly by glancing at the figures.

Boring Operations

The larger sizes of blowers and pumps are made with four-piece cylinders as indicated in Fig. 2, the two sections bolted together at each side forming a half circle. The four sections are planed along the joint surfaces, drilled for bolts and dowel pins and are then closed to form a circle and bored in the horizontal machine in the same manner as a single-piece cylinder would be machined.

The tool illustrated in Fig. 8 is a Niles boring machine with 30-inch hollow bar carrying two boring heads and two heads for facing.

In Fig. 9 is shown the method of boring the boxes in the head plate for the impeller shafts. These boxes are so constructed as to provide ample means of adjustment and alinement of the impellers is thus maintained at all times. The boxes are placed in their planed housings, in the head plates and then bored out in the Beaman & Smith machine to the required center distance by adjusting the boring-machine head and outboard support to scales fixed in the base of the machine.

Details of Patent Journal Box

The halftone, Fig. 9, and the line engraving, Fig. 10, show the box construction clearly. The bearing is made up of four removable sections lined with babbitt which is compressed in its seat. The sections are then accurately planed and when placed in their positions in the jaws of the head plate are ready for boring in the manner illustrated.

The bottom quarter of the bearing is the full width of the journal-box frame and is cored out to form an oil reservoir for the ring oiler. The bottom of this bearing section is planed tapering from each end and rests upon a pair of wedges or shoes planed to the same taper, and connected by a rod and nut by means of which they may be drawn toward each other to elevate the bearing members. The quarter bearings at the sides rest on the bottom quarter and are provided with means of adjustment as indicated.

The cap hooks over the side walls and is held down by studs so that it clamps the inner members of the bearing rigidly together.

Gear and Impeller Adjustment

The heavy proportions of the driving gears for the impellers are well brought out by the view in Fig. 1. This also shows the special form of key with which one gear in the pair is fitted in order to permit a slight amount of adjustment in setting the impellers to rotate properly

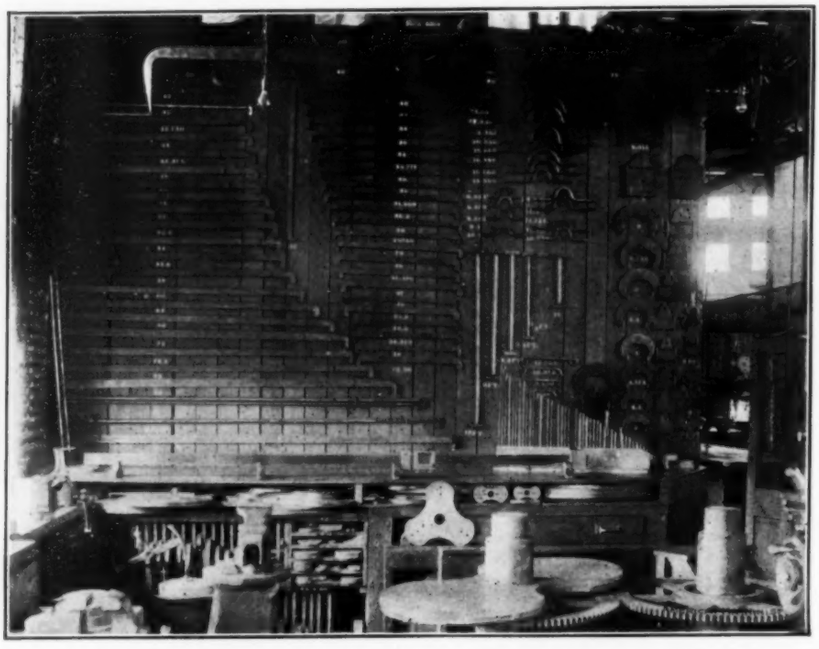


Fig. 7. A Tool-room View with Impeller Templets in the Foreground

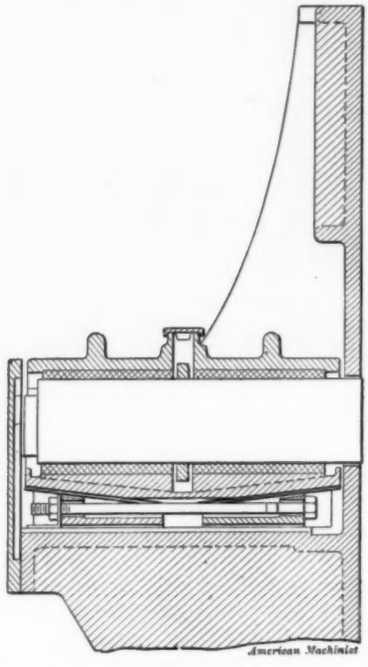


Fig. 10. Section through Bearing

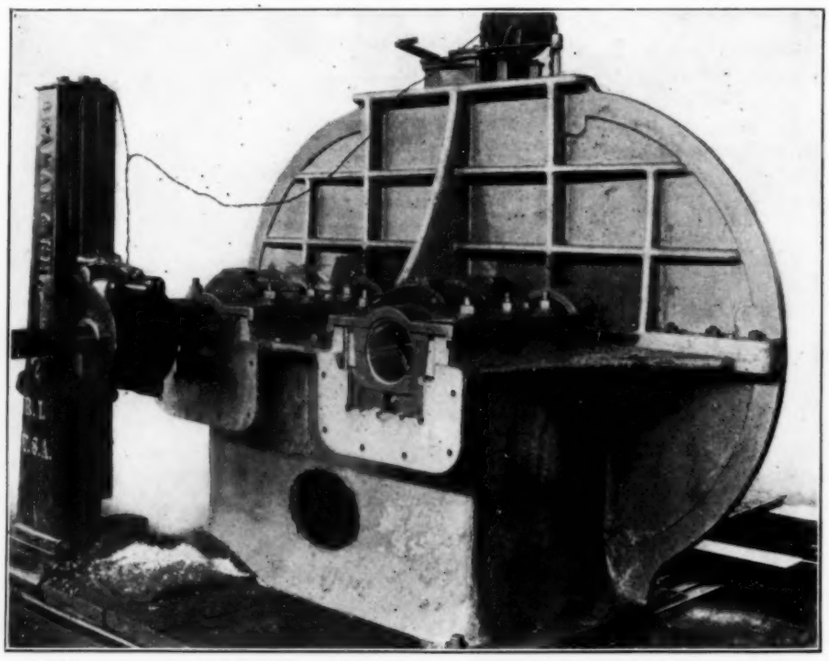


Fig. 9. Boring Bearings in Blower Heads

together. It is obviously impossible on work of this kind to cut the keyways in the shafts and gears in such accurate relationship to both the impeller lobes and the contacting faces of the gear teeth that the gears may be keyed in place positively with the assurance that the lobes will match together with just the desired amount of clearance. So to provide for a limited but sufficient amount of angular adjustment of one gear about its shaft, the form of key shown in detail in Fig. 11 is applied.

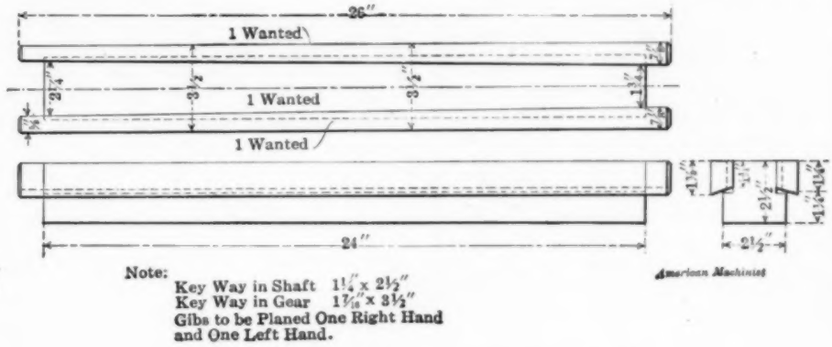


FIG. 11. GIBBED KEY FOR 10-INCH SHAFT

This is a gibbed key, the body of which fits in the shaft in the usual way, while two taper gibs along the top half (which is also tapered to suit the gibs) bear against the sides of the keyway in the gear. By withdrawing one gib and driving in the other the required working relationship between the lobes of the impellers is readily secured.

In connection with the keying method, Fig. 12 is presented as showing the way in which the gears are set up, on an angle plate on the planer and the keyway cut through the hub by a long tool extending from the planer head. The end of the tool bar is fitted with a pivoted head which swings up and relieves the tool upon the return stroke.

ALLOWANCES IN HEAVY WORK

The impellers on all of the machines are required to work with little clearance between the lobes and between the lobes and the cylinder walls. On the larger blowers and pumps the amount allowed is surprisingly small when the size and peculiar form of the members are considered. Thus, in the case of a blower like that shown in Fig. 1 with impellers perhaps 6 feet in length and having lobes of possibly half that radius, there is allowed between the lobes a clearance of about 0.030 inch, and between the tips of the lobes and the cylinder wall only 0.008 to 0.012 inch on the horizontal line, although at the bottom this is increased somewhat to permit of a reasonable amount of wear in the bearings without undue decrease in the clearance.

The amount of clearance is tested at all points between the lobes themselves and between them and the cylinder walls by long feeler gages that may be passed between the surfaces under inspection.

SMALLER APPARATUS

The small pumps and blowers are built in quantities by methods represented in part by Figs. 13 and 14. The impellers in Fig. 13 are milled on the ends in strings on a fixture which is passed between a pair of inserted-tooth straddle mills. The form of the lobes enables the castings to be readily secured by simple clamps placed between each pair of impellers.

The outside of the impellers is milled to the required contour by gang cutters formed to suit the work. In the gang illustrated there are three interlocking mills which cover one-half the surface of the casting. The other side is surfaced by indexing the casting half way round. The impeller is mounted on an arbor which is clamped in the V-blocks and is further supported at the middle by a wedge-shaped shoe that is adjusted into contact with the work by a nurled-head screw.

The cylinders for these small impellers are faced in gangs on the planer and bored on special fixtures in double-spindle machines which finish both half circles in the case at once.

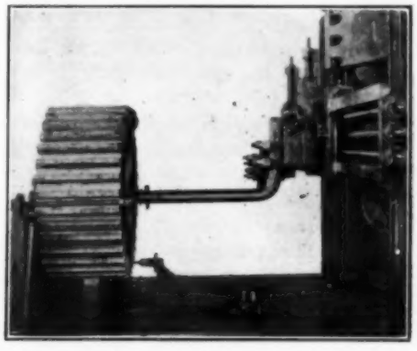


FIG. 12. PLANING KEYWAY IN GEAR HUB

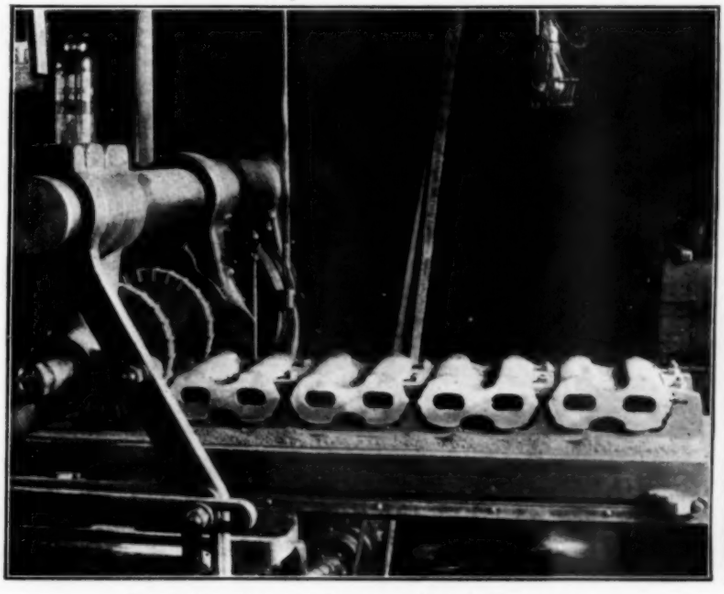


FIG. 13. MILLING ENDS OF SMALL IMPELLERS

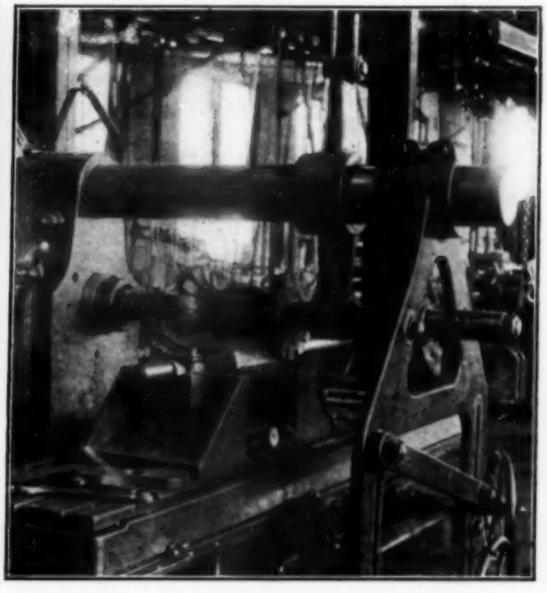


FIG. 14. A FORM MILLING OPERATION

Foreign Trade—Financing Shipments

By Archibald J. Wolfe

The easy solution of this problem on the part of the American manufacturer is to sell for "cash against documents in New York." An explanation of the use of bills of lading, hypothecation paper, insurance certificates, shipper's invoice and consular certificate. In general drafts should be made out in pounds sterling, not in dollars.

It is perhaps more true of the machinery business than of any other industry that the question of financing foreign shipments finds an apparently easy solution on the part of the manufacturer by the iron-bound rule of "cash against documents in New York." It is natural that it should be so. In fact, very frequently the manufacturer is justified in even refusing to begin the construction of some complicated or special machine without a substantial advance payment on the part of the foreign customer.

An attempt to preach to the manufacturers of machinery that they should adopt an illogical policy in the matter of extending credits is entirely outside of the object of this article. But whether the manufacturer grants credit or not, there are certain features connected with the financing of the transaction with which he should be thoroughly conversant, and he should also know how to make it possible for him to be as liberal in the treatment of his foreign customer as when dealing with a customer at home, similarly situated.

In fact, it is recognized by manufacturers whose foreign business experience has advanced beyond the experimental stage and who have passed their export novitiate, that there are ways and means to make the export business as safe and sane as selling at home, and indeed there exists no necessity of selling abroad on a more risky basis.

Hard and fast rules, of course, cannot be laid down that would cover all of the branches of the great machinery industry without suitable modification. Different points of view govern selling machinery to a dealer and to a consumer; selling special machines and supplies that must be constructed to specifications and those built in standard styles and for stock—as, for instance, grinding rolls of a certain diameter and in certain sets to illustrate the former, and typewriters, sewing machines or certain standard machine tools to illustrate the latter. Then, again, it makes all the difference in the world if you build or sell some patented tool that your customer simply must get from you or do without, or if you sell an article in competition with other manufacturers at home and abroad.

In the first instance, the wise manufacturer will always thoroughly inform himself concerning the financial standing of his foreign customer, as well as regarding his character and reputation, whether credit transactions are involved or not. There are well known ways and means of obtaining such credit ratings through the prominent mercantile bureaus, or credit bureaus connected with manufacturers' organizations or through banks at home and abroad. Manufacturers should not apply to American consular officers for such information, for they are debarred from furnishing it.

Where the circumstances are such that no credit need be granted the financing of the export shipment is a comparatively easy matter. In case the machinery ordered is built to specifications a sufficient advance payment should be demanded to cover the costs of construction and material and possible loss. It is not necessary to compel your customer to remit the entire amount involved in advance. He can easily arrange for a bank credit in New York through his domestic bank. In this way he is not out any money, excepting a reasonable interest and commission, until the machine is ready for shipment; on the other hand, the manufacturer is fully protected.

It is astonishing, however, how some transaction that is apparently as safe as lending money to the United States Government may turn out all wrong in a most unexpected way, which shows the necessity of being entirely conversant with the proper methods of doing business abroad.

An Experience with a Mexican Customer

A sugar plantation in Mexico sent an order to an American manufacturer for machinery amounting in value to almost $6000. One of the most prominent Mexican banking institutions engaged itself in writing to guarantee the transaction, promising to pay for all the machinery ordered and accepted by the plantation. The standing of the plantation appeared good, though no special credit report was obtained. The guarantee by the bank appeared gilt edge and unequivocal. The manufacturer went to the trouble of constructing the machinery which was not wanted until a certain time—say six months after the order was placed. In the meanwhile some exigency, which I cannot now recall, a poor crop or the reorganization of the company, compelled the customer to cancel the order. The machinery could not be used for anybody else, having been built to suit the special needs of the customer. The Mexican bank refused to pay because it guaranteed "machinery ordered and accepted by the customer." The result was a law suit still pending and likely to remain pending for years, thanks to the cumbersome and involved legal machinery in Mexico.

An Experience with a South American State

Another instance of an altogether unexpected snag in what appeared to be an absolutely safe transaction, which luckily resulted in an adjustment plus interest on a most liberal scale, illustrates a different phase of a difficulty with a foreign machinery shipment. A manufacturer of engines received a very attractive order from the government of one of the states composing the republic of the United States of Brazil. The shipment was to be delivered at the destination against the payment of documents. Here appeared a very safe business deal. The customer was a state backed by almost incalculable natural and financial resources. The shipment was in the hands of a forwarding agency with instructions to surrender only against cash payment at destination. It happened, however, that due to political troubles certain appropriations were not granted by the legislature of the state in question. Latin-American legislatures are after all not so very different from those in our own favored land. The agent of the forwarders at the destination refused to surrender the shipment and left it at the custom house pending adjustment. But he reckoned without his host. The engines were badly needed, money or no money—and the custom house belonged to the customer. The government of this particular state by virtue of its sovereignty simply helped itself to the shipment and the agent was powerless. The manufacturer was aghast when he failed to get his money and the forwarding agency set all levers in motion to compel payment. In due course there arrived an official settlement not only in full for the value of the shipment but even with the addition of very liberal interest.

Documentary Acceptance Bills

We have already mentioned how the foreign customer can arrange for pay-

ment of cash against documents in New York, either by remitting through his bank at home or by arranging for a banker's letter of credit in New York. We may briefly touch now upon how a concern whose standing has been thoroughly investigated and found good may arrange the payment for his shipment on the basis of documentary acceptance bills.

The following is a specimen of such a documentary acceptance draft:

Documents to be Surrendered on Acceptance.

New York City, U. S. A.
June 15, 1911.

Exchange for
£500-0-0

At sixty days sight of this FIRST OF EXCHANGE (the second of same tenor being unpaid), pay to the order of ourselves Five Hundred Pounds Sterling, value received and charge same to the account of

International Machinery Co.

To Anglo-South American Bank,
London, England.

No. 1378.

The following documents must accompany this draft: (1) Through bills of lading. These are made out to the order of the shippers and indorsed by them in blank. In this manner the title to the merchandise is vested in the holder of the bill of lading. Under no circumstances should the bills of lading be made out to the order of the customer. At the same time they should not be made out to the order of the bank buying the bills either, for then the manufacturer would be compelled to sell the bills to that particular bank and no other. If they are, however, made out to the order of the shippers and indorsed in blank, the shipper has the situation in his own hands. (2) Document authorizing the bank which purchases the bill to sell the goods in case payment were refused for them. This is called a hypothecation paper. This is not necessary where a contract to the same effect is made between the manufacturer and the bank to cover all foreign drafts issued by the manufacturer to his banker. (3). Marine-insurance certificate made out in the name of the shippers. Where the insurance is attended to by the customer abroad a statement to this effect must be attached. The inland risk is covered by the common carrier's bill of lading at home. (4) Shipper's invoice. This must state the price for which the merchandise is sold, gross and net weights, freight, insurance expenses, etc. (5) Consular certificates, inspection and weight certificates, shipping notes, etc. Each country has different regulations regarding these, and the contravention of these regulations or the failure to comply strictly with them leads to fines and other troubles. It is, however, beyond the aims of this article to discuss them.

An acceptance draft, with the above documents attached, can be readily sold by the manufacturer to his bank in any commercial city in the United States for a very reasonable commission, and the manufacturer is immediately in receipt of his funds. On the other hand, the customer is not forced to disburse any funds until the goods reach him; the transaction is thus taken care of to the complete satisfaction of the parties concerned.

It must not be forgotten, however, that only a thoroughly responsible customer should be sold on this basis. For in case payment is refused, the bank has a recourse on the manufacturer.

A Remarkable Export Fraud

A very remarkable instance of this occurred a few years ago and the fraud that was practised on the manufacturers and the banks in this connection led to the imposition of severe penalties on the perpetrators thereof. A forwarding agency which had been doing a conservative and legitimate business on lower Broadway, put this "kink" into a system which, for years has worked to the complete satisfaction of manufacturers, their customers and the banks making a specialty of financing foreign shipments. The very rarity of this bold attempt, however, serves only to bring into relief the eminently safe and satisfactory nature of the system of doing business on the basis of accepted drafts with thoroughly responsible customers, literally hundreds of thousands of shipments being satisfactorily handled by such means.

The owners of this agency, two brothers, chafed under the hardship of accumulating money by tedious, legitimate means. So a large number of manufacturers suddenly began to receive notices from a concern bearing the noncommittal name, "General Supply Company," of Townsville, Queensland, stating that representatives of that firm would be on a certain day in New York and would place large orders for machinery and supplies, payment for which would be made by the "..... Shipping Company." There was no time to investigate the standing of the customers, because the goods had to be on board of a certain steamer by a given date, besides the forwarders in question (quite well rated at the time) guaranteed the accounts. The goods were delivered on board of the steamer and the drafts were turned over to the forwarders. The latter, not content with having obtained possession of goods enough to stock a town, went around and by a good deal of hustling succeeded in selling the drafts to various banks. Thus the manufacturers were not only out their goods, but also out their value in cash. How the conspirators made for Honduras with their pirate ship, instead of Queensland, and how justice overtook them both, is a matter of export history.

This solitary instance, as already mentioned, cannot upset the fact that financing foreign-machinery shipments on the basis of acceptance drafts attached to documents of shipment is an all-around desirable method.

In General Make Out Drafts in Pounds Sterling

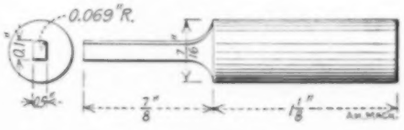
It will be noted that the specimen draft shown above is made out in pounds sterling. With the exception of perhaps Mexico and very few other Latin-American countries it is safest and best to make out these drafts in pounds sterling. London is the financial center of the export trade and the mechanism of the international interchange of drafts has London for its hub. Why this is so, is beyond the scope of the present article to discuss. If the draft is made out in dollars a considerable loss would be incurred when shipping to Brazil, or Chile or many other countries. There is, for instance, in Chile no exchange rate direct on New York, but there is a recognized exchange rate for 90-day drafts on London. The banker in Chile, receiving a draft in American dollars, will first convert it into pounds sterling at his own rate, and then reconvert it into the Chilean currency, involving double charges. The exchange rate in Chile is understood at 90 days sight. This, of course, refers more to drafts sent for collection to foreign countries direct, but does not alter the advisability of converting dollars into sterling.

Completing a Piercing Hole without a File

By W. Edwards

I was recently called upon to make a die with a piercing hole the shape of the broach shown in the accompanying figure. As the dimensions were too small to permit filing, I decided to broach the hole to size.

I turned a piece of Stubs steel, ½x2⅛



Completing a Piercing Hole without a File

inches, to within 1/64 inch of the finish size and hardened it. I described a circle on the face of the universal grinder as large as the chuck would permit, and divided it into four equal parts. I ground the piece to 0.138 inch diameter, and then ground the sides with a cup wheel, making sure that the divisions I made were in line with the center of the head and clamping securely with the friction screw.

I also made a taper broach in the same way, and broached the clearance in the die, thus completing the die without the aid of a file.

Special Features of the Elmore Shop

Special machines are always interesting to the real mechanic, whether the machine was designed for work in his particular line or not, for they are often of suggestive value in the solution of shop problems near at hand, and two of the most interesting special machines in a number of ways, that can be found in an automobile shop, were built by the Elmore Manufacturing Company, Clyde, Ohio, for boring out the main and distributor bearings in their crank cases, which, of course, must be in exact alinement. As the motor made by this company is a valveless two-cycle, the bearings mentioned are the only ones bored in the crank case, there being no cam shafts used.

The company claims that by the use of these machines, shown in Fig. 1, they are able to turn out with each one more than four times as much work as by any other means, besides doing truer and better work.

Special Correspondence

Details of a special vertical boring machine with a novel feeding mechanism and other unusual features. Drilling jigs and boring machines for cylinder work. Motor testing methods.

As the halftone shows, each machine consists of a heavy combination base and drip pan into which two upright steel shafts are set. Near the bottom of the shafts cast-iron cross pieces *A A* are solidly bolted, to which the crank case is clamped during the boring operation. To the top of the upper cross piece a bracket *B*, carrying two hardened and ground steel bushings, is bolted for the purpose of guiding the boring bars. Another bracket *C*, holding two similar pilot bushings, is bolted to the bottom cross piece.

The carriage *D* is made to slide on the upright shafts or columns and is counterbalanced by the weights at *E* through the chain *F*, which runs over a loose sprocket above. Power is transmitted to the carriage for feeding and cutting purposes, from an overhead countershaft through the belt *G*, which runs under the idler *H*, around the pulley *I*, under the idler *J*, around the pulley *K* and back to the countershaft, which arrangement allows the carriage to be moved up or down without interfering with the drive.

The boring bars are driven through gearing from the shaft on which pulley *I* runs, and the feeding mechanism is operated by a friction-disk drive *L*, through worms and worm gears to the sprocket *M*, which meshes in the chain *N*. This sprocket is on a shaft carrying a similar sprocket on the other end, meshing in chain *O*. These chains *N* and *O* both run over loose sprockets on the overhead countershaft brackets and around sprockets fixed to each end of the shaft *P*. Now if shaft *P* is left free to turn, the motion of the sprockets on the carriage simply causes the chains to travel over the loose countershaft sprockets, but if shaft *P* is kept from turning by locking the clutch *R*, then the carriage will feed up or down according to the direction in which the carriage sprockets are turning. The rate, as well as the direction in which these sprockets turn, is easily governed by means of the feed and reversing lever *S*, and the drive belt is thrown out or in motion by shifting the lever *T*.

With the carriage sprockets at rest, which may be accomplished either by stopping the drive belt or by shifting the friction feed to neutral position, the carriage may be run up or down by hand by loosening clutch *R* and turning the handwheel *U*.

The machine at the left in the halftone is shown without a crank case in position and shows some details not visible in the other.

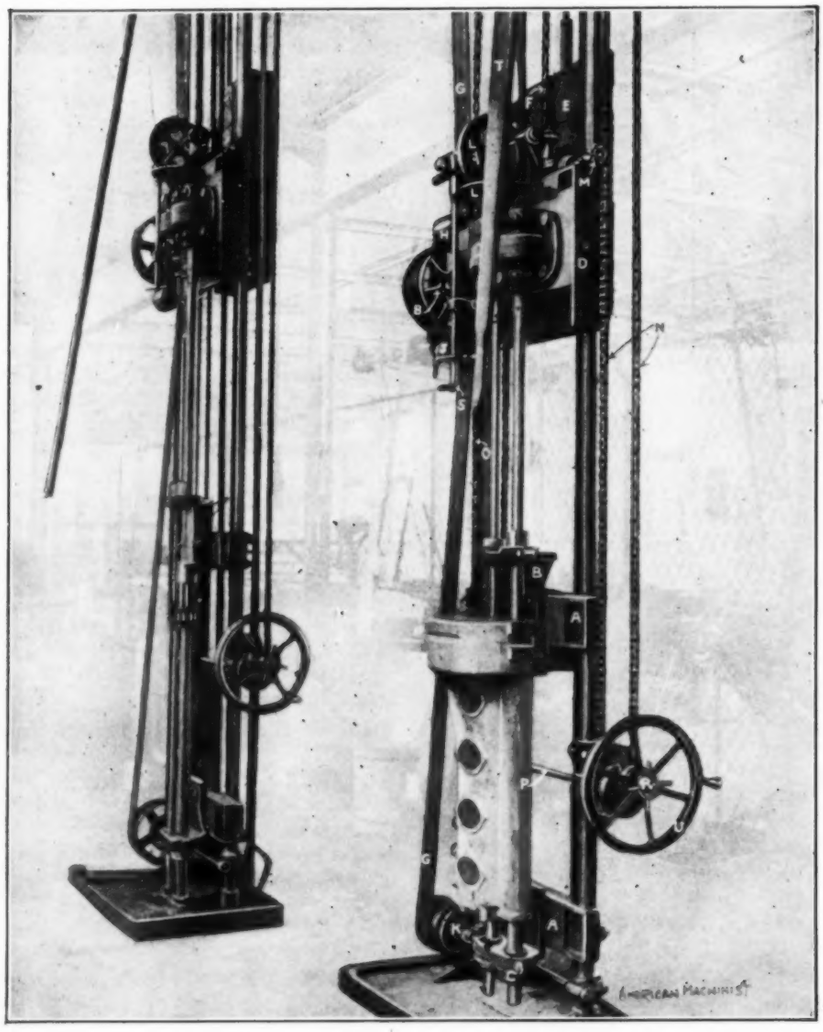


FIG. 1. MACHINES USED FOR BORING OUT MAIN AND DISTRIBUTOR BEARING HOLES

MILLING CRANK CASES

Previous to the boring operation in the machines just described, the crank cases are milled on the Ingersoll machine, shown in Fig. 2, which not only surfaces off both sides, but also the top and the slot for the bearing caps over the six main bearings at one pass. This miller is also used to simultaneously machine three surfaces on cylinder castings.

THREE-WAY INDEXING JIGS

Drilling, counterboring, reaming or tapping of the holes in cylinder castings is

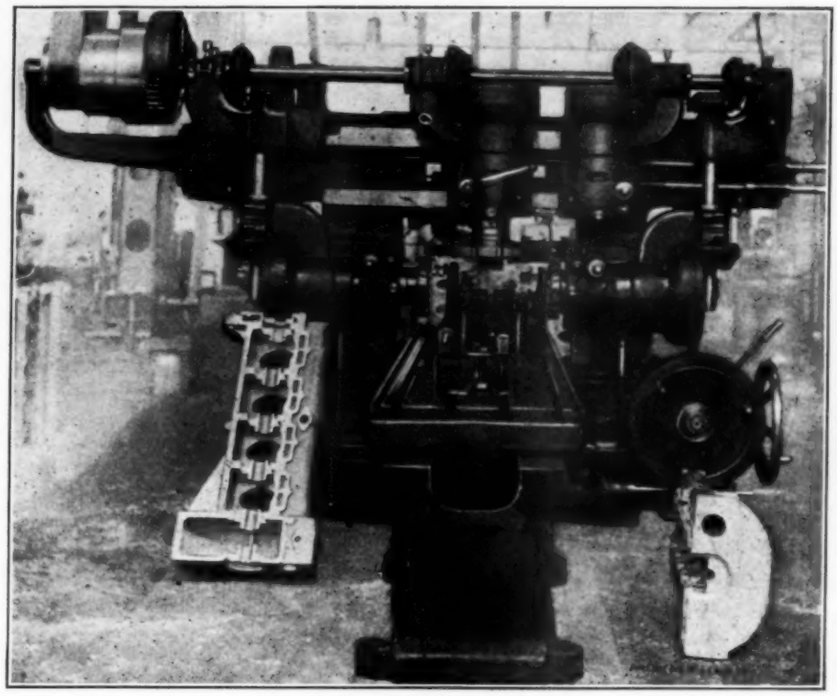


FIG. 2. MILLER USED FOR MACHINING CRANK CASES AND CYLINDERS

done in the three-way indexing jig, shown in Figs. 3 and 4, the construction of which is apparent. The use of this type of jig makes it possible to completely finish all the holes before removing.

BORING AND ANNEALING CYLINDERS

The cylinders are bored out in the machines shown in Fig. 5, which were built especially for the purpose, and turn out more than double the product obtained by former methods, which were then considered the best. The machines are very heavy and rigid, and bore holes true and round, of the same size from top to bottom, and it will be noted that the boring tools have no motion except that of rotation, the carriage carrying the cylinder castings doing all the feeding, which is in accordance with the best practice.

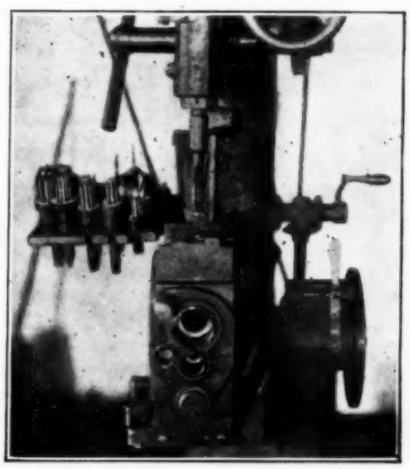


FIG. 3. THREE-WAY INDEXING JIG

In order to take out all the strain that is caused either by boring or the heat of the engines, the cylinders are annealed both before and after rough boring, and also before finishing.

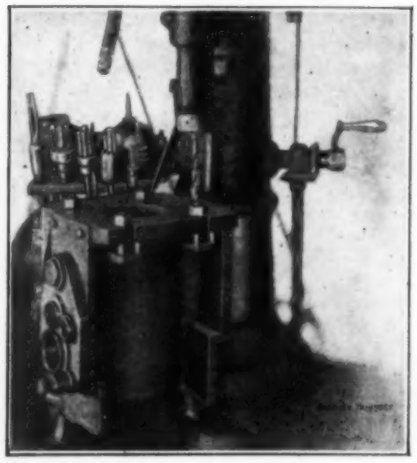


FIG. 4. JIG SET FOR DRILLING FLANGE HOLES

After the cylinders are finish bored, the pistons with the rings fitted, are attached to a special rigged machine for grinding the rings and pistons into the cylinder bore, and if there are any high spots in the cylinder, this lapping in with pumice stone and oil soon produces a practically uniform bore.

TESTING THE MOTORS

When the pistons and cylinders have been properly fitted and the motors assembled, they are placed on stands as

FIG. 5. CYLINDER-BORING MACHINES

shown in Fig. 6 and run for two days, the motors first being run by a belt and then, when properly loosened up, this belt is shifted over onto the loose pulley and the motors run on their own power, using natural gas for fuel. This test over, the motors are placed on other blocks, shown in Fig. 7, and are run with gasolene, using the carbureter that belongs to them. Following this, the engines are tested for horsepower on a Tracy testing machine, shown at the extreme right in the last halftone.

After leaving the testing machine, the motors go to the inspecting department where they are carefully gone over to see whether the elimination process that they have gone through has developed any bad rings, loose or imperfect bearings, or other undesirable features.

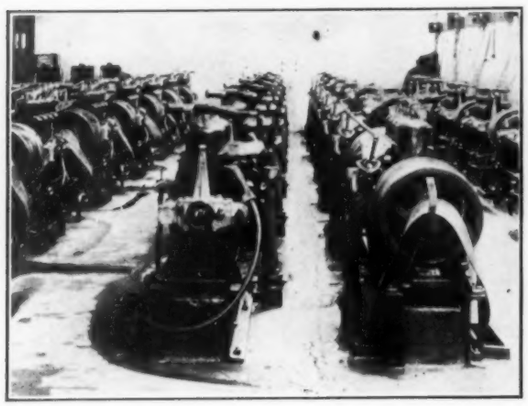


FIG. 6. FIRST TEST FLOOR

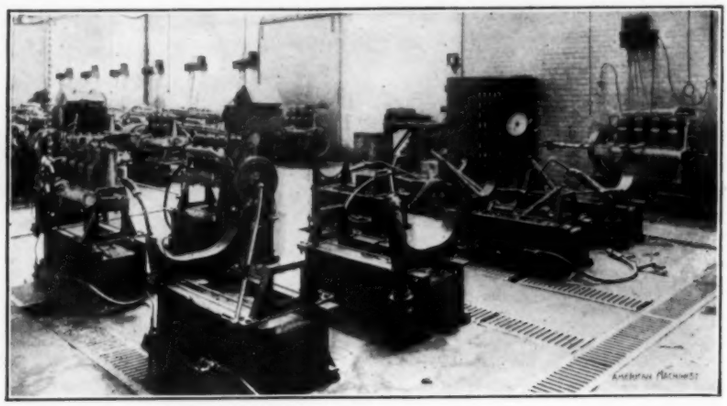


FIG. 7. SECOND TEST FLOOR

Chuck for Cylindrical Work

BY A. J. DINKEL

The chuck is used in boring the inside of a cylindrical bowl. It is also suitable for any cylindrical work of a similar nature.

The work it is now doing requires extreme accuracy, and that the inside and outside surfaces be perfectly concentric. Ordinary means of chucking proved inadequate as well as slow.

The bowl when finished runs on a ground spindle screwed into a tapered socket in the bottom of the bowl. The first operation is that of boring and tapping for the spindle. This is done with the bowl in the rough. The spindle is then placed in the bowl and used as a means of centering for the next operation, that of turning the outside. This makes the bowl true with respect to the spindle.

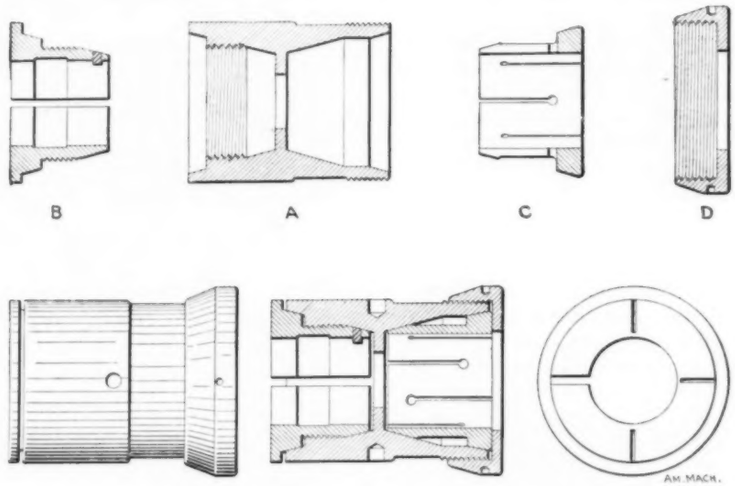
The next operation, that of turning the inside concentric with the outside, caused difficulty. The bowl being thin, it was necessary to construct the chuck so as not to spring the bowl in any way.

The chuck is used on a 2-inch Jones & Lamson turret lathe having a spindle that is not threaded. The screw bushing in the chuck enables us to take it off easily. The chuck guarantees a variation never over 0.0005 inch, remarkable for a chuck of its length, nearly 12 inches long. Besides, it saves a great deal of time and worry.

In cut *A* is the main body of the chuck, *B* is the spindle bushing, *C* is the bowl bushing and *D* is the nut by means of which the chuck is closed. The cast-iron cylinder *A* holds the bushings on the inside and is threaded for the nut *D* on the outside.

The inside of the bottom end of *A* is bored out with a 15-degree taper and threaded with about two inches of No. 4 United States Standard threads. The bushing *B* fits the inside of *A*, allowing a quarter of an inch for tightening. *B* is slotted in four places. One ⅛-inch cut was taken clear through, while the other three were cut to ¾ inch, allowing just enough to hold the bushing together. These slots give the bushing spring. As the chuck is screwed on the bushing, the taper forces the bushing to spring in. The slots allow it to give, thus causing it to clamp tightly around the spindle. The spring of the metal causes the bushing to release immediately as the chuck is unscrewed. Removing the chuck is very simple.

The other end of *A* is bored with two inclined surfaces of 15-degrees taper to receive the bushing *C*. The outside of the bushing is turned to fit with an allowance of ¼ inch for tightening. The center part of the bushing is relieved in order to make it yield more readily. The bushing *C* has six slots running lengthwise to give it spring. Three of these slots are cut from one end, and three from the other, so that the pressure will be the same on either end of the bushing.



A CHUCK FOR CYLINDRICAL WORK

The nut *D* bears against the end of the bushing so that as the nut is screwed on the chuck, it will force the bushing into the chuck. The taper of the chuck contracts the bushing about the work, holding it tightly and at the same time making it impossible for it to spring out of the true circle.

The spring of the bushing releases its grip the moment the pressure of the nut is removed. This makes the operation of chucking the bowls very simple, as no time is required for centering.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Of Value in Making Quarter-inch Mills

In making some quarter-circle mills, Fig. 1, I had occasion to use an attachment for backing off the teeth that may be interesting to others.

The steel headstock, Fig. 2, contains hardened-steel bushings as bearings for the spindle carrying the lap, and is secured at any angle in one plane, to the connecting arm by the binding screw shown.

At the other end of the arm, another binding screw binds it to the inner end of the spindle passing through the cast-iron stock. Between the housings of this, and on the spindle, a lever is also mounted; its curved end affords a ready means of lifting the lap when indexing.

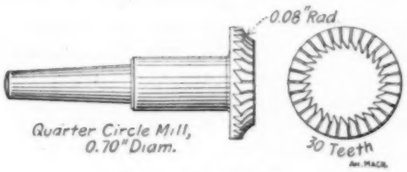


FIG. 1. THE MILL

By means of a setscrew attached to this lever small adjustments are obtained. By adjusting the lever in contact with the face of the housing, all end shake can be taken up. The attachment is fastened to the T-slot in the usual way.

After an approximate setting of the lap to the work, the belt is connected. The belt should be tight enough to cause the lap to move toward the work when the setscrew is turned to the left. It may be well to note that the belt is the only support that the attachment has for maintaining its position as drawn.

A straight lap is used first for truing up the arc while it is revolving. The lathe belt is then thrown off, the indexing pawl is attached to the headstock of the lathe, and its tooth placed in mesh with the notched flange of the pulley.

When the lap is set to one tooth, the setscrew in the lever acts as a stop for the remaining teeth, and as the amount of land left for relieving each one is small, a properly charged lap does the work rapidly.

It may be added that the difference of the diameters of the working end of the lap was 0.01 inch, the small end measuring 0.153 inch, while the large end measured 0.163 inch. By using the intermediate part, no difficulty was encountered in meeting the requirements.

Elgin, Ill. GUS HAESSLER.

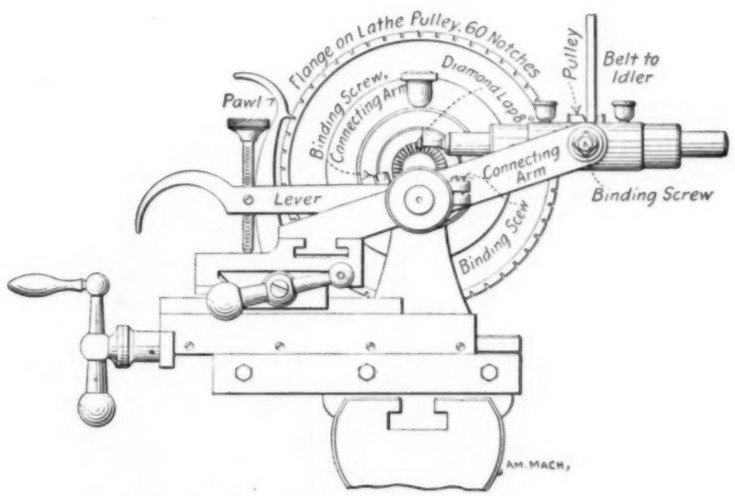


FIG. 2. THE ATTACHMENT IN POSITION

A Few Kinks

Quite often in finishing out hammering dies, and other diework that comes to the jewelry toolmaker, he wishes for some easier way of finishing besides the use of the graver and riffle file. Where one has the use of a dental engine or other flexible-shaft machine, it is an easier matter.

I prefer a dental engine with a light arm, as it does not tire the hand as much as some of the heavier types. Some dies that have to be opened to take in the stock have curves that are hard to cut and leave smooth. My way of cutting them is as follows: Take a piece of drill rod and turn down to fit the hand-piece or chuck of the flexible shaft. Then turn the working end to the desired shape; a few thousandths less than size required. Reverse the lathe and hold a file of whatever cut you wish on top of the bur with a slight downward pressure, and allow the file to travel with the work.

After running the file its length, lift it clear of work and a few teeth will be found on the bur. "Catch" these same teeth and repeat. The whole shape can easily be followed, except on a ball shape, where the end teeth can be carried over with a three-cornered file. Harden the end, and don't draw the temper very low; then you are ready to finish out the die and leave it comparatively smooth.

How many know what a great time saver a burnisher is in die work? In making hubs, after the scrolls have been brought to a comparatively good finish, use the burnisher and a fine glass finish can be had in a great deal shorter time than by polishing. Where dies are driven cold, of course the smoother the die the better the impression will be. After surface grinding, polish with a medium grade of emery or carborundum, and then wipe clean and burnish. For most work I prefer a small tapering steel burnisher of oval section, about 1 inch long by $\frac{3}{8}$ inch wide, at widest part, by about $\frac{1}{8}$ inch thick; for wetting the burnisher use soapy water. Quite often we have a screw to file the end round or flat or some other shape. It would not pay to make jigs or holders for one screw, and a screw is an awkward object to hold and not mar the thread or head without something of the kind.

I took a pair of flat-nose pliers, about $3\frac{1}{2}$ inches long, and bent the jaws into a curve so that the ends of jaws came together, leaving an opening about $\frac{3}{4}$ inch, like a pair of gas-pipe pliers, only smooth. On the ends I filed a wide angle *V*. The depth was shallow enough to

hold a No. 2 screw, and outer part of angle would still hold ¼-inch screw and the clearance would not touch heads of either screw. These plyers are very handy for holding many odd shapes.

Newark, N. J. F. CHESTER.

A Relieving Attachment

The accompanying illustration shows an attachment that, with slight modifications, can be fitted to any lathe, and which is used for giving a uniform relief to recessing toools. The results are very satisfactory.

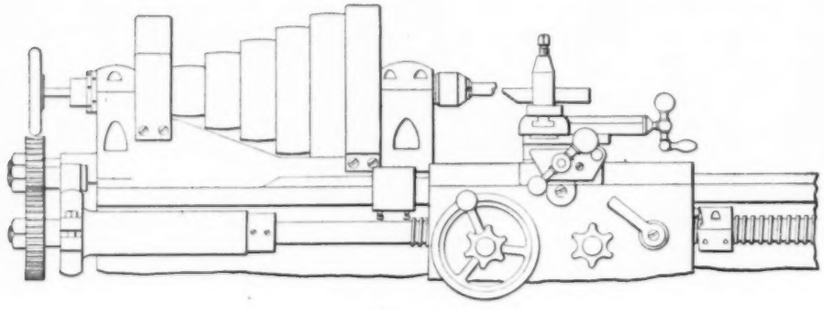


Fig. 1

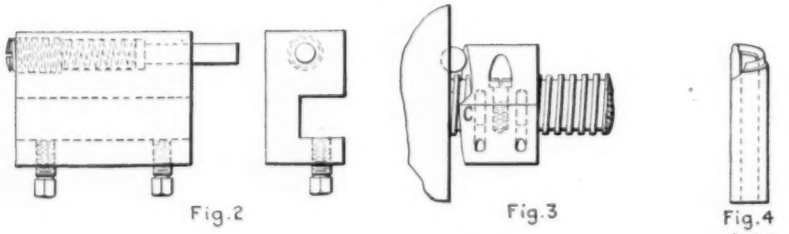


Fig. 2 Fig. 3 Fig. 4

A RELIEVING ATTACHMENT

So far it has only been applied to one-lipped tools, but I see no reason why it could not be used on tools with two cutting edges.

The cut, Fig. 1, shows the attachment in place on the lathe. The lead screw should be geared to the same number of revolutions as the lathe spindle.

A forged tool is shown in use, but in practice we use a tool the same shape as the recessing tool, but with slightly more relief, and held in a special holder. This tool has a pilot which fits the hole in the recessing tool and, besides locating the tool central with the lathe spindle, also tends to give a much smoother cut. One of the tools is shown at Fig. 4.

The cam, Fig. 3, is split, threaded internally to a good fit on the lead screw and the two halves doweled and held together with screws. The two halves must come together, at the same time binding on the lead screw. If there is any space at this point a ridge will be left on the tool.

The cam can be made with a different rise at each end and can be reversed. Theoretically one cam is correct for only a tool of a certain diameter, as the angle of the relief of the tool grows less as the diameter increases, but where there is not too much difference in the diameter of the tools, two double-ended cams will be found to be sufficient for all practical purposes.

Fig. 3 shows the cam in contact with the hardened ball, which in turn is in contact with the end of the lathe carriage. As the lead screw turns, the ball is forced against the end of the carriage by the rise of the cam, causing the carriage to move forward, compressing the spring shown in Fig. 2. When the ball reaches the point *C* on the cam, the spring forces the carriage back to the starting point.

The compound rest is set parallel to the ways of the lathe and the tool fed up by hand.

Ilion, N. Y. A. L. LOWE.

Buying Machine Tools

A few years ago, when a young foreman, my firm decided to replace some old lathes with new ones especially adapted for their work. The first intimation I got of this was in the board room, when I was asked what lathes I would recommend, a question which landed me in a very precarious position. Although I had some very good practical experience with lathes and also had read the AMERICAN MACHINIST, this side of the business was quite new to me.

Up to this time I had very little interest in any mechanical journal beyond the reading columns, but I made a vow that day never to be caught again. From that time, my profession has been more interesting in many ways.

A different man faced my directors the following week. I had selected my lathes from a close study of the advertisements, backed up with my practical experience. In one case, I had cut from this journal an article that gave a "day's work on the lathe" that was exactly similar work to our own. My opinions were accepted. The lathes provided were very successful and for a time I felt convinced that my real vocation was a machine-tool salesman, but I was young then.

Since that time I have devoted regularly two or three hours weekly to the advertisements; this has proved very interesting and instructive. For some years, I have held a position that carries with it a large influence, and in many cases the final word in the selection of machine tools. Sometimes this has been done after careful study of the advertisements, as photographs show up the bad points as well as the good; sometimes a man while telling you the good points of his machine is also (quite unconsciously, of course) giving you the bad points of some other.

Sometimes, in studying the advertisements, I nave disliked the descriptive matter and have tried to improve this on my own account. My pet aversion is a photograph of a machine that displays a "flower bed" of spanners around it. These are, of course, (to use an Irishism), given "free, gratis, and for nothing," but they are still very costly unless absolutely indispensable.

Recently I passed over a machine that included eight spanners in the "free outfit," and selected one that required only three; I had a sort of suspicion that the fact that it was two to one against the workman's lifting the right one had something to do with my selection.

In conclusion, many firms, in selecting machinery, are very apt to accept the lowest estimates unless someone is at hand who can judge each machine independently, and dollar against dollar. The foreman or manager who cannot do this will soon find someone else doing his work.

Belfast, Ireland. F. P. TERRY.

Hack Saw Blades

A large number of hack-saw blades are ruined daily by using them to saw thin sheet steel, etc.

It is not generally known that a piece of wood about ¼ inch to ⅜ inch thick, placed in the vise with the job will allow the blade to cut clean and not dig in and break, with the result that the next man does not have to go and get a new blade. This is worth a trial in any shop where no very fine-toothed saws are kept.

Tirbox, England. T. PARRY.

The practice of the Packard Motor Car Company, is to make the front wheels of their automobiles flare two inches at the top and "toe in" from ⅜ to ⅝ inch in front.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Testing Surfaces with a Glass Plate

The article on the above subject, appearing at page 682, Vol. 34, possessed more than ordinary interest, and would be read, I am sure, by the average toolmaker and fine machinest with not a little surprise. It is a sort of article which leaves one wishing for more of it, and I for my part, although I have had considerable experience in this line, am always glad to read such interesting matter; fine measuring methods and testing have a fascination.

I have known an accurate piece of French plate glass along with a good

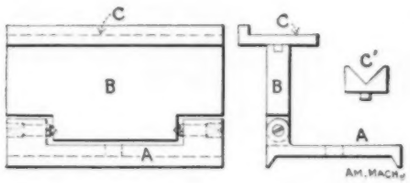


FIG. 1. DEVICE FOR LAPPING LONG BARS

straight-edge to be used for making small surface plates, the plates when finished comparing favorably with those made in sets of three. I have also used the glass for testing size blocks, although I never knew until I read this article that they could be actually measured by the colors, nor that they had a value in this direction. When testing a surface with glass, as a small size block, I usually stand facing the light and hold the plate up with thumb and finger of one hand, along opposite edges and the gage with the other. I have a piece of black cloth over my hands shutting out the light from the back; in this way I find that I can see the high spots more clearly. I also find it an advantage to have rubber tips on my fingers as they help to protect the gage or block from the heat of the fingers.

Referring to Fig. 1, page 682, and regarding the ½-inch size block and the way it was lapped, I cannot exactly make out how the lapping was done on the corner of the lap. Indeed if it was done with the ordinary rubbing to and fro method the results are exceedingly good. Perhaps your valuable paper will tell us more about this lapping in the near future.

Some two or three years ago I read an article in the AMERICAN MACHINIST about the Swedish gages (I think Dixie wrote it). I thought I should like to make gages like them. I tried many ways of lapping, but could not get the exact results although I used very accurate laps and had had much experience on lapping. I always found that the corners were a little low and the center high, although not perceivable with a fine knife straight-edge.

I then tried lapping with a revolving disk holding the block on a steady. I found that the surface was much flatter, but it was next to impossible to make two sides parallel because the outer side of the lap, acting upon the gage and traveling at a higher velocity, always seemed to lap more off that part of the gage which was outermost. By turning the gage over to try and make it equal simply made it worse because it then left a high ridge in the center.

USE OF TAPERED LAPS

However, after much trying we made some laps like Fig. 2. They were tapering from the center outward and gave fair results from the first. We afterward made three of the following tapers, one was 0.030 inch taper per foot, another 0.020 inch per foot, and the third was 0.010 inch per foot. We found that by using these laps, we could make a gage or block hollow by holding it on the lap and very slowly revolving it in an opposite direction to the rotation of the lap. We also found that by making these tapers in varying amounts, as those mentioned, we could produce varying amounts of hollowness in the block being lapped. We could also, finally, take out what hollow there was in the block by holding the corners alternately, upward and outward on the lap, the corner meeting the higher cutting action of the outside of the lap.

I can thoroughly recommend this method, which is very quick, and by it I find no difficulty in producing gages equal in every respect to the Swedish gages; of course, you must use the glass plate for frequent testing. I have duplicated all the tests that have been made with Swedish gages, which seemed impossible with ordinary lapping. Perhaps the way in which I use the laps will be of some assistance.

The first lap, which I call the roughing lap, is ground 0.030 taper per foot and then charged evenly all over with 10-minute carborundum powder well rubbed in. I usually leave the blocks 0.0015 inch large, from grinding for lapping. With this first lap I lap until the corners of the block show prominently and I am measuring 0.0007 inch large in the center. I then transfer operations to the second lap, the one ground taper 0.020 inch per foot. This lap is charged with 200-minute flour emery washed three times. On this I work the block down to 0.0003 inch above size. I now have, or ought to have, 0.00015 inch on the two opposite faces to lap off, so I must use extra care. I transfer again to the third lap, the one tapered 0.010 inch per foot. This lap is charged with diamontine (diamond dust?) mixed with olive oil and best used in a room free from drafts and dust and of even temperature. When lapping on this lap I now finish one side to glass plate getting a true surface. I then commence operations on the other side, carefully testing with the glass plate and measuring. I find that with a bit of common sense and a little care I get a gage with a beautiful mirror-like surface, thoroughly accurate and which will wring with another gage quite as tenaciously as any Swedish gage.

The laps are made from close-grained thoroughly seasoned, cast iron. I find that

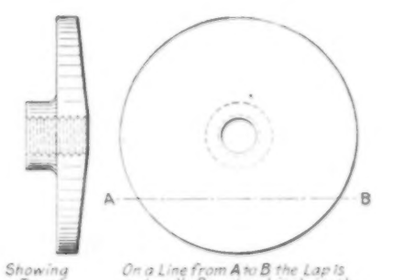

A
B
Showing Taper Exaggerated
On a Line from A to B the Lap is naturally Round and is obviously the Cause of making the Work hollow.

FIG. 2. TAPER LAPS

cast iron lasts and keeps its shape longer than anything else, besides it is not so yielding to any imperfection of a piece being lapped.

Block gages should have some boiling treatment or other after hardening and after grinding be allowed to settle for a week or two. If this is not done you will generally find that a week or or so after lapping the gage shows hollow on the glass plate. This means lapping again to

a smaller size. It may be thought that 0.0015 inch is too much to leave on for lapping, but I do this because in the end I find that it is quicker and in many cases necessary, to get rid of all grinding imperfections, crosswised, etc. Also the gages come down rapidly on the laps.

As a suggestion for an instrument for measuring with this light-interference system, probably one could be made on the taper-wedge principle. I have seen machines built on this system for very fine measuring and would rather use them than measuring off a precision screw.

Fig. 1 shows a device for lapping long bars which cannot be held steadily by hand; it is also very useful for the short ones.

The simplicity of the device calls for nothing beyond a brief description. It should be well made and the parts *C* and *C'* accurately fitted and part *B* swung on true centers. It will then be found a very useful article for many different lapping operations.

Part *A* is the base, *B* the swing, *C* and *C'* the holders for parts to be lapped, *D D* hardened and ground steel ball centers, well fitted and adjusted by the grub screws behind them. All parts except *D D* and the grub screws are made from gray iron. The device can be made to suit a machine of any center.

Leicester, England. T. POWELL.

A Tool Room Index for Laying Off Angles

Mr. Guion's angle index, page 1201, Volume 34, looks good to me.

I am not satisfied, however, with Mr. Guion's statement that, "such a tool as the one shown may obviously be made to give results of the highest degree of accuracy." In this case that is neither here nor there, because the question arises, can *any angle* be laid off in degrees, merely, or in minutes, or even in seconds?

There are a definite number of graduations on the disk *A*, and their ratio to 360 gives the angle of revolution for each division. What that ratio or angle is has not been stated and is not apparent from the illustration. If, for example, there are 1080 divisions on the disk *A* the ratio will be 3 to 1, that is each degree will be divided into three parts. The angle of rotation, therefore, is ⅓ of a degree or 20 minutes.

Of course, the accuracy of spacing for both notches and graduations will determine the accuracy of the device, but not its predetermined range.

Buffalo, N. Y. ARTHUR F. KUNZE.

Chart for Number of Teeth in Milling Cutters

On page 79, Volume 33, Part 2, commenting on the general excellence of the formula for determining the number of teeth in milling cutters, given by J. Butterworth in a previous number, A. W. Boase gives a table of numbers for cutters of from 1 to 12 inches of width and diameter each, that have been worked out from the formula.

This is the first simple formula that I have seen, that does not break down at some point or other. Generally, the simple formulas break down when used for side and face mills of less than one inch width, and although this particular formula does not break down, there is a weakness at this point when applied to the thinner cutters of large diameter. For instance; we have, for a 6-inch diameter mill, ⅜ inch wide, 44 teeth, giving a pitch of 0.43 inch; while for a 3-inch diameter cutter, ⅜ inch wide, we get 24 teeth, giving a pitch of say 0.39 inch. This is not enough to quibble about, but why should the 3-inch cutter have a finer pitch? Looking at the cases in

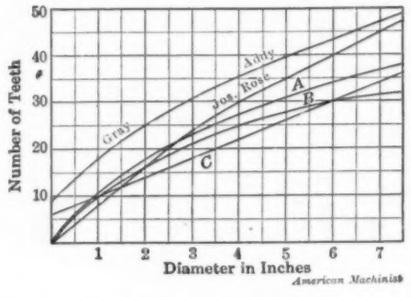


FIG. 1. EXPERIMENTING CHART FOR INAUGURATING STANDARD PITCH OR NUMBER OF TEETH IN MILLING CUTTERS

question from the point of view of strength, the real view, the larger diameter cutter should have the finer pitch. This must not be considered as an adverse criticism of Mr. Butterworth's formula, for it is the best I have seen, and there is a real necessity for the publication of such.

The necessity for some sort of standard from which to work is very real. More especially is this so when the milling comes under, say, four or five foremen, whose opinions on the matter will vary from modern practice, to the rotary file of 25 years' ago. It fell to my lot some five years ago, to inaugurate a standard, under such conditions, for a department having from 100 to 120 milling machines, and the difficulty of getting a simple formula that would cover the whole range of milling-cutter practice was then brought home to me.

Fig. 1 shows a chart that was gotten out from various formulas at that time, which shows incidentally, how the tendency has been to make coarser the pitch of the teeth, the higher curves coming from the older formulas. The author's names are given on the two upper curves. Curves *A* and *B* were plotted from formulas given in a translation from a German technical paper of six or seven years ago, the formula being given as:

$$\text{Pitch} = \frac{D}{10} \pm x,$$ and x varied from 2/10 to $-1/10$ in one case, and from 3/16 to 0 in the other.

Curve *C* is the one that we finally adopted for finger and slab mills, the equation being:

$$N = 6 + 4D;$$

where *D* is the diameter in inches.

This chart, however, was used only as a basis for the chart shown in Fig. 2. In this it will be seen that side and face mills have separate curves to cover different widths of cutter. One curve is given for finger mills and finishing slab mills, and another for roughing slab mills. This roughing slab mill curve was added about two years after the chart was plotted, and at the same time the value of the curves for the side and face mills was altered; the ½-inch curve becoming, as shown, ⅜ inch, and the ⅝ inch becoming ½ inch, etc.

This is one great advantage that a chart has over a set of tables; one can so easily compare it with any formula, and if desired, alter by putting on an extra curve, the others always remaining as a record. Another advantage possessed by a chart is that when mounted upon a board and varnished, it fills a blank place on the wall and is always available for reference. It might be mentioned that the side and face mill curves were all derived from practice, and as originally plotted were connected by a weird equation having about five terms in it, which however, having the chart, I have conveniently lost.

A chart of this type is not complete without a line or two to show the lead of spirals for various diameters and angles. At present I am using 14-degree spiral on finger and finishing mills, and 20 to 25 degrees on roughing finger and slab mills, with an occasional slab mill of 30 degrees spiral and fewer teeth. Charts of this kind are very useful, but one should never hesitate to change them when the necessity arises. The tendency is toward coarser pitches and larger angles, but it must always be borne in mind when making standard cutters for large shops, that all the machines are not of the latest pattern, so some concession to the old machines must be allowed for in the cutter design.

This chart, Fig. 2, has been in use in the tool room of the Royal Carriage Department, Woolwich Arsenal, for the last 5 years, and on a varied class of work has given general satisfaction.

WALTER G. GROOCOCK.

Woolwich, England.

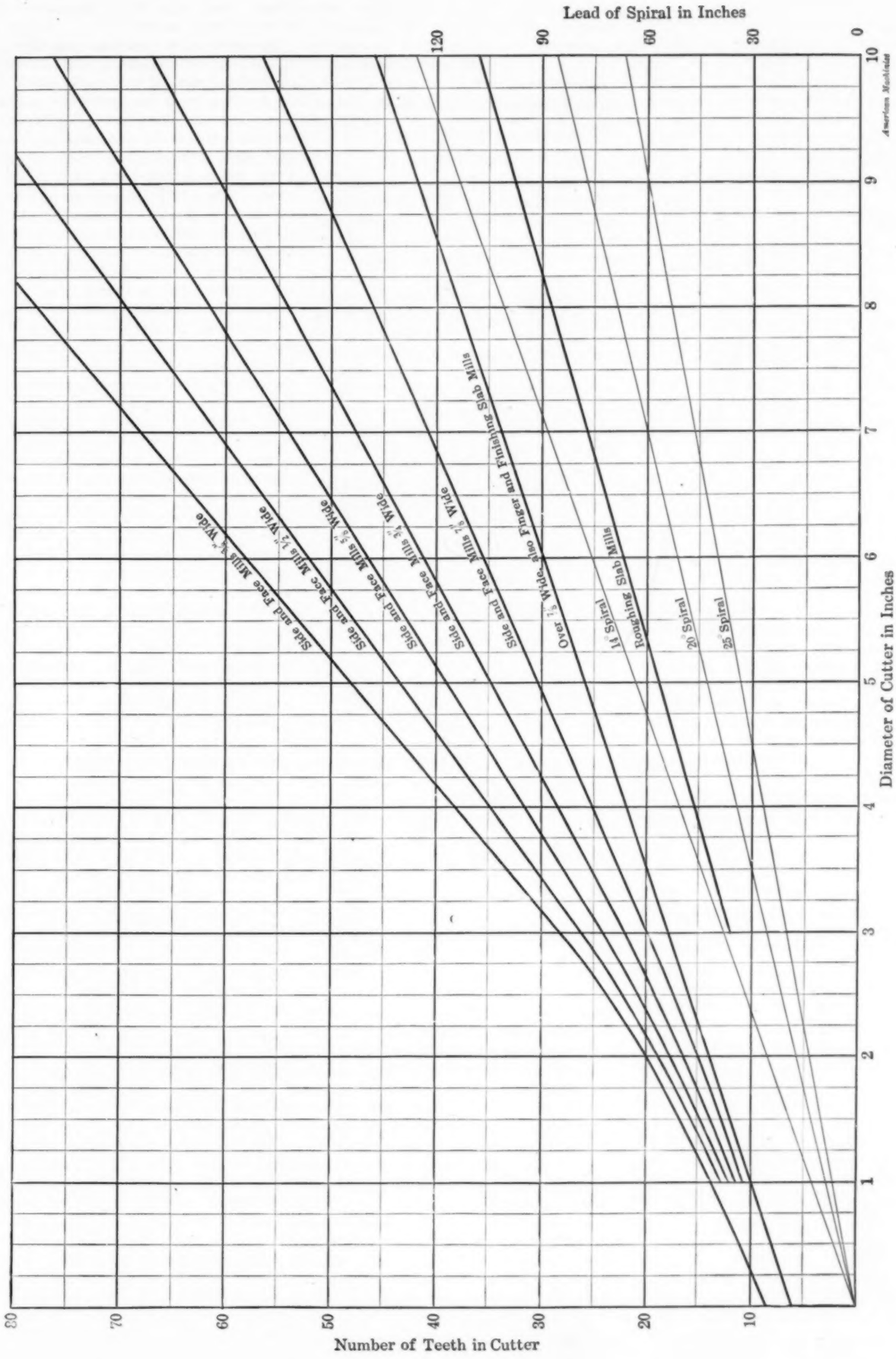


FIG. 2. CHART FOR GIVING THE NUMBER OF TEETH IN MILLING CUTTERS

Pitch vs. Number of Threads

When using formulas for the depth of thread, etc., and in figuring the proportions of taps and dies, a great deal of confusion—and possibly spoiled work—is caused by the indiscriminate use of the term "pitch," represented by *P*.

Quite recently we adopted a form of thread for the finer pitches, that was described in these columns as the "Cadillac" form of thread. Since adopting it I have had to figure the proportions of a large number of taps, dies and thread gages. While doing this work, I was struck by the confusion that seems to exist regarding the use of the term "pitch;" it being used very often when the number of threads is meant.

Not very long ago, in a discussion in these columns of "Lead vs. Pitch," it was very correctly decided that pitch meant the distance from the top of one thread to the top of the next, regardless of the lead of the thread. But in spite of this we find many using it incorrectly.

It is very evident that if we had a thread to cut 10 per inch, that the number of threads per inch is 10, and the *pitch* is $1 \div 10$; expressed in a formula this would be $\frac{1}{N}$, where N = number of threads per inch. I cannot see how the pitch and number of threads can both be the same, yet a correspondent, L. E. Middleton, page 988, Volume 34, gives a table and formula for the depth of thread, and, in the notation, says, "Let P = pitch or number of threads." In an algebraic formula, this is an impossibility. He gives the formula for the double depth of a V-thread as $\frac{1.732}{P}$, whereas it should be $1.732\ P$; this is very easily proved by a little elementary mathematics.

Now, $P = \frac{1}{N}$, or the pitch in inches equals 1 inch divided by the number of threads; therefore, substituting, $1.732\ P = 1.732 \times \frac{1}{N}$, or $\frac{1.732}{N}$. Then the rule is to multiply the constant by the pitch or divide the constant by the number of threads per inch.

The AMERICAN MACHINIST handbook, page 34, uses the term pitch in this way, and I have used the formulas given on this page in all my work; I find them very simple and convenient. Pages 24 and 25 of the handbook, taken from Brown & Sharpe catalog, refer to readings of thread micrometer calipers. Here, however, the term P is used in just the opposite way again, and the formulas are given $\frac{0.6495}{P}$ and $\frac{0.866}{P}$, instead of $0.6495\ P$ and $0.886\ P$.

To an inexperienced person this is very confusing. I have had occasion to explain this difference in formulas a number of times lately, and it is with a view of having another one of our troubles eliminated that I am presenting my experience to the readers of the AMERICAN MACHINIST.

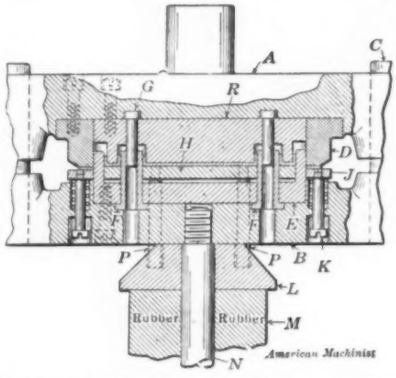
ELMER A. ERMOLD.

Philadelphia, Penn.

Blanking, Piercing and Drawing Die

On page 407 appears an article and illustrations descriptive of a very interesting die for producing a tray-shaped cover from nickeled steel, and I would like to make a few comments regarding it.

The principal criticism of this die would be that it is unnecessarily expensive and complicated for the work it has to perform. It is always objectionable to use a spring-supported die bushing if it can possibly be avoided, as the springs, of course, have to be very stiff to stand the punching pressure and they are usually shorter than is consistent with long life unless the die is very bulky. Another bad feature is that of having the disks from the piercing punches fall down through the helical springs, for the writer has seen many good dies ruined by this particular feature, on account of the disks catching in the spring convolutions and packing the die, the result being



BLANKING, PIERCING AND DRAWING DIE

broken punches and bushings, if nothing more serious.

The designer should remember that unskilled labor will usually be employed in the press room of the average firm, and the press operators get to be semiautomatic in their actions, seldom giving intelligent thought to the treatment of dies, or stopping to examine them now and then to see that they are in good shape. Of course, no two designers, as a rule, view the requirements of a tool from the same standpoint, and each is going to produce the device that he fancies to be the superior method.

The writer had occasion some time ago to design a die for producing a rectangular can cover with round corners and having two large holes in the central portion, with a lip turned inward around them. As this condition so closely approximated that for which Mr. Erb's die was designed, I feel sure that a short description and cut of the method used will be of general interest.

The material in this case was 22-gage aluminum, and the cover was blanked, pierced and flanged in the die shown in the accompanying cut, and it will be noticed that there are no spring bushings for piercing and that the scrap stripper is the only place where springs are used, for which purpose they are perfectly legitimate. The disks from the piercing punches fall through a clear channel and a heavy rubber bumper serves to actuate the ejector plate.

Referring to the cut, *A* and *B* represent respectively the upper and lower portion of a subpress and are of cast iron. The guide pins *C* are of tool steel, hardened and ground, and are driven into the lugs on the four corners of *B* so that the upper portion of the subpress *A* may be accurately guided by them. The tool-steel blanking die *D* is doweled and screwed to *A*, while the blanking punch *E* is similarly fastened to *B*. The drawing or flanging punch *R* is of hardened tool steel and is located within the blanking die *D*. It also acts as a die for the hole flanging punches *F*, which are tool-steel bushings and form dies for the hole punches *G* to enter. *H* is a soft-steel ejector and pressure plate supported on the four pins *P*, which in turn are pressed upward by the rubber bumper *M* below the plate *L* and acting on the stud *N*, which is screwed into the subpress base *B*. *J* is the scrap stripper and slides around the blanking punch *E*, being pressed upward by helical springs recessed in the base *B* and having its travel limited by the shouldered screws *K*, as shown in the cut.

The action of the die is as follows: The blanking die descends over the punch *E*, cutting the round-cornered rectangular blank and the piercing punches *G* at the same time pierce the holes in the center of the blank. The flanging punch *R* then draws the blank down inside the blanking-punch depression and over the hole-bushing dies *F*, compressing the bumper *M* and the scrap-stripper springs under *J*. The finished piece is ejected by the plate *H* and the scrap is stripped by *J*. The principles embodied in this die are adaptable to many others for flanging or edging sheet-metal parts.

Detroit, Mich. ARON LAWRENCE.

Aron Lawrence criticizes the die shown on page 407, as being unnecessarily expensive and complicated, and shows a type of die designed to overcome these objections.

His die is simple and well designed, but is closely limited in application to those cases where only a slight draw or shallow flange is required. When the depth of shell is such as to require a blank holder, or pressure ring, to prevent wrinkling and consequent tearing of

metal at the corners—and tools are to be used in a single-acting press, and positive objection is made by the user to having the scrap punchings from inside holes discharged through the top of the die—there is no alternative but to complicate the design and increase the cost of the die by using spring-held bushings.

The dimensions of the shell produced in the die described by me are: Length, 5 inches; width, 3¼ inches; depth, ⅜ inch; inside eyelets, 1 inch in diameter, 7/32 inch deep.

Careful design will eliminate the possibility of choking through punchings catching between convolutions of the spring. In the particular die described by the writer the piercing punches were very heavily sheared, and the resultant punchings deeply fluted. Further, the inside diameter of spring was made as large as possible, and the draft in bushings allowed each separate punching to drop freely.

If space for springs is limited, a thin-walled sleeve driven or sweated into the bushing, and extending through spring will effectually prevent trouble from this source.

In regard to descriptions of dies, would it not greatly increase the value of the article if the part produced in the die were in every case clearly shown by line drawing and fully dimensioned? A seemingly slight change in dimension of the part to be made will often entirely change the design of a die, and therefore complete information regarding the piece made will greatly assist the designer and toolmaker in determining the limits of application of the die. I have looked over the article describing the battery top punch and die, and see that, outside of the gage of the metal, there is absolutely no information regarding the shell produced and Mr. Lawrence is, therefore, justified in presuming that the type of die he describes would serve the purpose of the one shown by the writer.

Jersey City, N. J. E. M. ERB.

Handwheel Grinder

In connection with Mr. Heald's article, "Finishing Handwheels on a Grinder," page 1161, Volume 34, a machine embodying the same basic principle and constructed exclusively for this particular work, may be of further interest.

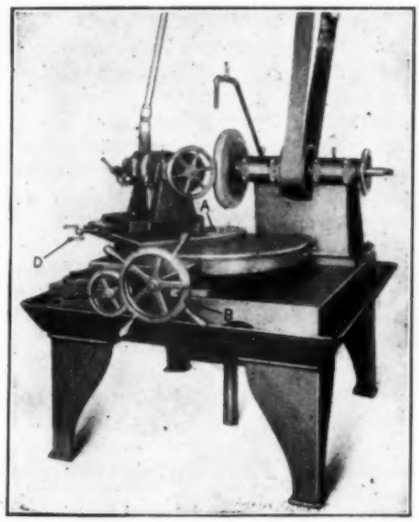
The accompanying illustration shows a special grinder built by the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, for its own use, and now in operation in its plant.

The spindle carrying the grinding wheel is mounted in a head securely bolted to one corner of the table of the machine and driven by belt from a countershaft.

The rough handwheel to be ground is mounted on the overhanging end of the work arbor and rotated by a driver engaging one of the spokes of the wheel. This work arbor is driven from a separate countershaft through a shaft and universal couplings.

The head in which the work arbor is journaled is mounted on a table which swivels in a horizontal plane about a stud *A* directly under the point of contact between the work and the grinding wheel. This table is slowly rotated by hand by means of a worm wheel and worm turned through the large handwheel *B*.

The small handwheel *C* moves the entire table and its swiveling mechanism in and out at right angles to the grinding-wheel spindle to give the proper adjustment for grinding wheels of varying diameters. The small ball crank *D* moves the head carrying the work arbor in a line at right angles to this arbor, to feed the work to the wheel and to give adjustment for work of varying diameters.



HANDWHEEL GRINDER

This machine produces nicely finished handwheel rims from rough forgings or castings.

HENRY M. WOOD.

Cincinnati, Ohio.

Less Finish on Machine Tools

I am very much interested in your editorial, "The Waste of Money to Buyers of Machine Tools," page 1139. I think that this is a subject that should be brought very forcibly before the machine-tool buying public of the country.

I started designing special machine tools about 15 years ago for use in one of the largest factories of the country and devoted all of my energies to producing a machine that would deliver the goods and keep on delivering them. I paid no attention to the appearance of the machines; in fact, some of them are still running and have never had a coat of paint. Of course, this was going to an extreme, but it didn't injure the efficiency of the machines in any way.

Some time after this, when I was designing some machines for the market, they were built along the same lines and advertised as machines built of the proper design, proper material and properly fitted, but not finished expensively. I soon found that this would not win, as many of the concerns got a lasting impression of a machine by its first appearance and if it looked somewhat rough, it prejudiced them against it, and it started in under a handicap.

I found that the machine-tool buyers were the greatest sticklers for plenty of filler and dead-smooth surfaces, which, we shall all have to admit do go a long way toward producing a fine appearing machine.

On a good many machines, I know that the total cost of this extra filling and rubbing is from 10 to 15 per cent. of the cost of the machine. As you have suggested, this is money entirely wasted as far as production and efficiency go.

I do not believe it would be possible with the present state of feeling of machine-tool buyers, to successfully market tools without this extra work, but I do believe that your article should be the opening gun in the campaign for eliminating this extra expense and that the machine-tool buyers should receive the benefit of it.

Moline, Ill. WILSON P. HUNT.

The Word "Driller"

Your editorial "Miller-Grinder-Driller," page 947, has struck exactly the right keynote in proposing to use and urging others to adopt the shortened names designating machine tools.

About the first of the year we adopted in all of our advertising and printed matter, in our letters and in every way possible the word "driller," designating all our various styles and types of machines. Its use has been very satisfactory to us. In our business correspondence every one of us is trying to make things as concise, as compact and as expressive as possible; the use of these abbreviated words is a step in the right direction.

Already, many of our customers are asking about "Hoefer Drillers;" hence, it is easy to see that the adoption of this name is rapidly taking place in the trade. The AMERICAN MACHINIST has always stood for a progressive policy, and I am glad to note that it is urging the adoption of these modern designations.

Freeport, Ill. C. A. HOEFER.

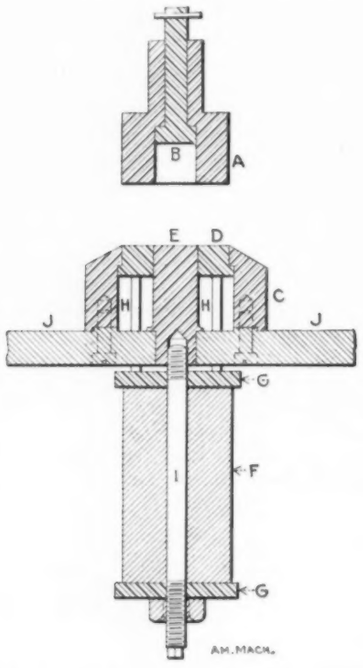
Blanking and Drawing Die

The line cuts show another way of making the dies for the job shown by A. Whitby on page 1129, Volume 34.

A is the punch. *B* is the punch knockout. *C* is the cutting ring. *D* is the pressure ring. *E* the die pad. *H* the pins which communicate pressure from *G* to *D*. *F* the rubber buffer. *I* the rod car-

rying the buffer *F* and the end plates *G* with a nut for adjusting the pressure. *J* is the bolster.

In operation the punch *A*, descending, cuts the metal at the cutting edge of *C*. The blank is then held between the punch *A* and pressure ring *D*. As soon as the pressure ring *D* gets below the cutting edge of *C* it compresses the rubber buffer *F*, which prevents wrinkling. The punch *A* continues to descend, forming the metal around the die pad *E*, until the blank is drawn the required depth. As



COMBINATION BLANKING AND DRAWING DIE FOR SINGLE-ACTION PRESS

the punch ascends the pressure ring *D* strips the shell off the die pad *E*. When the punch emerges from the die the press knockout strikes the upper end of punch knockout *B*, throwing the drawn shell out.

This method of double-action die construction for single-action presses has been found satisfactory in drawing brass as heavy as 9/64 inch thick.

WALTER J. WOODWORTH.

Brooklyn, N. Y.

Cadillac Screw Threads

Much has been published pro and con regarding the Cadillac screw thread. Granted that the necessary clearance should be allowed between male and female thread, and that the Cadillac form is fine, why should the peace of the manufacturer and the consumer be further disturbed by any more adaptations of machine-screw standards? There is now a plenteous variety of standard (?) machine screws in existence, all having some excellent qualifications to recommend them. The writer is connected with a shop where twelve machine-screw standards are used in manufacture and for repair work. No; these standards were not adopted by choice but no more varieties will be accepted. Not even the Cadillac with all its theoretical perfections.

What the manufacturer and consumer want is a *standard*. It may not be perfect. The dimensions of the American Society of Mechanical Engineers' standard machine screws are not perfect. Serious fault may be found in some details. But they are standard and may be purchased to standard limit gages. The limits for taps specified for American Society of Mechanical Engineers' screws are too large and cannot be used for close work. But now that the American Society of Mechanical Engineers' standard screw has been adopted to supersede gradually eleven others, no consideration of tap and die manufacturers, no enticing arguments on the merits of Cadillac screw threads will offer any inducement to modify the American Society of Mechanical Engineers' standard screw one iota.

Of course, manufacturers of taps and dies tell all kinds of tales of what they must do to get the proper clearance, of how difficult it is to furnish taps to close specifications, how special gages must be used to inspect their taps, why the pitch diameter is the essential element, etc. (We tell the consumer of our product similar tales.) But there is at least one tap and die manufacturer who will furnish at reasonable cost the quality and size of taps and dies required. And after one or two rejections and an appeal to the pride of reputation for accuracy, the manufacturer of gages produced some excellent sets.

Beware of the Cadillac man. You cannot refute his argument. His theory is correct. You feel small and insignificant when he tells you what improvements he has made over such an imperfect standard as a body of mechanical engineers had the temerity to recommend. But did you ever note that the Cadillac man confuses cause and effect, and that he changes his screw standard in order to make his taps standard?

The Cadillac man does not confine his activities to screw standards, but he invades all dominions. No standard is too sacred for his impious ways. When he comes to my office I take him out to the shop to see the twelve standards.

Philadelphia, Penn. A. R. CROPTIC.

Advice for Apprentices

I have read with interest the article on "Training the Power of Observation," by James C. Davies, page 1083, Volume 34. It seems to me that Mr. Davies has given a lot of time to a very good cause, but I think he might have given the other side of the question the same consideration. I take it that the desire of the Worcester Polytechnic Institute is to turn out good engineers; otherwise they would not have instituted this new line.

Now, what I mean by the other side of the question is, the shop foreman's side. I think Mr. Davies will uphold me when I say that quite a large percentage of students, when they come into the shops, seem to forget that the shop is run as a profit-making concern and not as a place of amusement. He says that students are made the butt of jokes, when they come into shops, because they know little or nothing concerning the simple things of machine construction. As regards that, I do not think for a moment that any workman would refuse information if it was asked for in the proper manner, and this is one of the most important points, the manner of asking for the desired information.

Speaking from the foreman's standpoint, I should like to advise all students when coming into the shops to forget all outside influences, and remember the old saying: "When in Rome, do as the Romans do." They should try to bring themselves to see that everything has a beginning, and that even the simplest operation is worth doing well, even if it is an irksome job, as centering forgings, for instance. They should never be above giving a lift where needed, and above all things, if working in a gang, always do their share, because workmen are very quick to pick out the lazy ones, especially if it is in a piece-work shop; this applies especially to fitting and erecting shops, as in machine shops each man or lad works by himself.

There are few things I always have made a point of telling students, when they start in my shop: "In the first place keep good time; do what is given you to do intelligently and well; see that you get all necessary information concerning the job before making a start on it; and don't be afraid to ask me any question concerning the work."

I have spoken to my fellow foremen in the other departments, and they seem to have the same bother with the students, namely, lack of application.

Leeds, England. J. D. SMITH.

The composition of cast iron for locomotive-cylinder castings, according to *Railway and Locomotive Engineering*, has been carefully estimated by expert mechanical engineers as follows: Graphitic carbon, from 2.75 to 3.25 per cent.; silicon, 1.25 to 1.30; phosphorus, 0.50 to 0.80; combined carbon, 0.50 to 0.70; manganese, 0.30 to 0.60; sulphur, 0.06 to 0.10. It is stated that the presence of sulphur in an excessive degree is one of the deep evils to be particularly guarded against in the selection of cast iron, while the proper mixture of silicon is also of the utmost importance.

Bearings in Woodworking Machines

By Herbert T. Towle

High speeds of shafts and spindles make journal heating in this class of machinery a constant danger.

Typical applications of ball bearings, with decidedly successful results.

Woodworking machinery presents a peculiar problem, as regards bearing maintenance. The shafts or spindles run at enormous speeds compared to those of most other classes of machinery, ranging from 250 revolutions per minute in spoke lathes to 12,000 revolutions per minute in dowel machines and small shapers. To attain these speeds without exceeding the safe limits of belt speeds the pulleys must be small. This results in what is popularly called "center pull" of the belt. That is to say, the belt tension must be considerably greater than would be necessary if the pulley diameter were not restricted by belt speed. To such an extreme is this sometimes carried that in a vertical shaper one may find such a seemingly incongruous collection of elements as a 2-inch journal, a 3-inch pulley, over which a 4-inch belt runs, driving a cutter smaller in diameter than the pulley itself, at a speed of 8000 to 10,000 revolutions per minute. Owing to the necessity of preventing the cutter from sticking, under any circumstances, when it encounters knots or a specially heavy cut, and owing to the further fact that the distance from countershaft to machine is often short, the belt tension is considerably in excess of that made necessary by the average requirements of the work. In a word, the belt tension must be sufficient to meet the the maximum demands of a very variable cut.

The Danger of Journal Heating

It is easy to understand from the facts above mentioned that journal heating is frequently encountered in woodworking shops. One would suppose that journals running at such high speeds under heavy pressures, and doing comparatively light average work, would be very carefully lubricated. Owing, however, to the difficulties of providing flooded lubrication, we find that the usual method of oiling is by means of the time-honored wick feed, from a well which is occasionally refilled. If the shaft be horizontal, the oil well is placed beneath, and the wick sucks the oil up to the shaft. If the shaft be vertical, an arrangement similar to that shown in Fig. 1 is commonly used. The oil reservoir surrounds the journal, which, as the cut shows, is tapered to provide take-up for wear, by shifting the body up or down, and a wick draws the oil over the top of the reservoir, to the journal. No attempt is made to return the oil for further use, as on account of the flying dust it would be of no value.

Obviously the coefficient of friction resulting from such a limited supply of oil must be far higher than would be possible with oil-bath lubrication. Where so much oil must be used—and wasted—the annual consumption is a serious item.

From this it follows that the hot-box problem in woodworking factories is a serious one. Bearings wear loose, and impair the quality of the work by producing a rough cut, and every now and then a machine must be shut down for rebabbitting. Occasionally an intractable machine will be found, which must be dosed with oil every few minutes to keep it working at all. Estimates have placed the amount of power wasted in friction in woodworking machinery at from 20 to 60 per cent. of that delivered at the belt, depending on the type of machine and the size and speed of the cutter. Obviously a eight-horsepower planer, for example, cannot waste three horsepower in friction without the waste power manifesting itself to the detriment of the bearings.

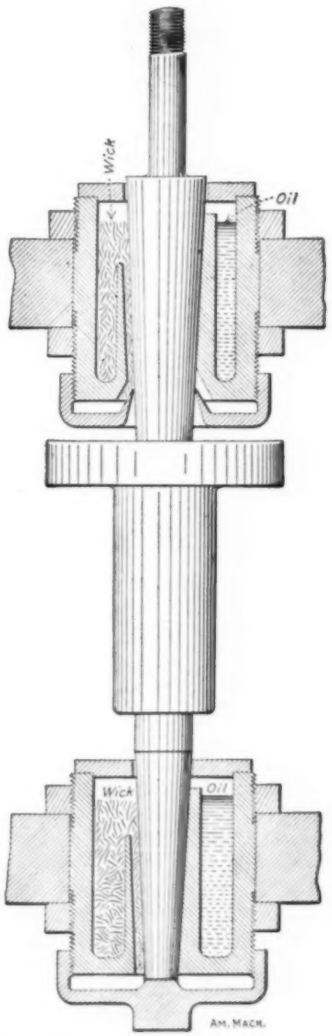


Fig. 1. Typical Arrangement of Vertical Wood Shaper Spindle

Application of Ball Bearings

The logical way to save the bearings is to eliminate the friction. This is accomplished by successful application of annular ball bearings, an improvement which is now well beyond the experimental stage. As a good modern ball bearing is practically frictionless, it runs cool, and, if properly mounted and not overloaded, is practically devoid of wear.

The explanation of the failure of the early ball bearings is to be found in many shortcomings not suspected at the time. The steels used were insufficiently hard and were not uniform. The cup-and-cone type of design itself was at fault in not permitting the ball to have a true rolling motion. The balls were not perfect spheres, nor were the cups and cones true within the necessary limits of error. Consequently, the load which should have been distributed between several balls fell on one, with speedy destruction of that one, and of the bearings, as a result.

The modern scientific study of ball-bearing behavior and construction has overcome these faults.

An Economic Consideration

Economy of fuel, which in some conditions, as in line-shaft hangers, is the leading consideration in the use of ball bearings, is secondary where woodworking machinery is concerned, since, where water power is not used, the scrap is burned under the boilers, and in many cases this scrap is sufficient without purchase of additional fuel. Nevertheless, the time has already come when even the fuel question must be seriously considered. The supply of timber is no longer unlimited; and while, of course, the fire box is the best place for useless scrap, it no longer follows that it pays to waste stock recklessly, on the theory that it costs nothing. If the demand for fuel were cut in half, as it easily might be, by the use of ball bearings in the machinery and the line-shaft hangers, it would, in most cases, be found that the half of the scrap thus saved could be put

to marketable use. In Germany, where ball bearings were first used in woodworking machinery, the value of lumber is sufficient to make economy an object, and the same is true in this country. The tendency of the times is all away from the industrial waste which has hitherto characterized manufacturing methods, and in the direction of scientific economy.

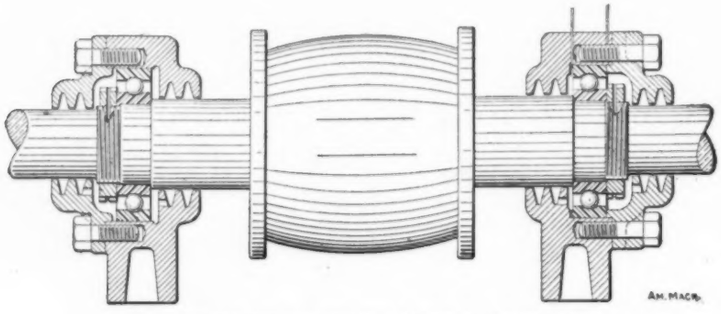


FIG. 2. MOLDING-MACHINE CUTTER SPINDLE

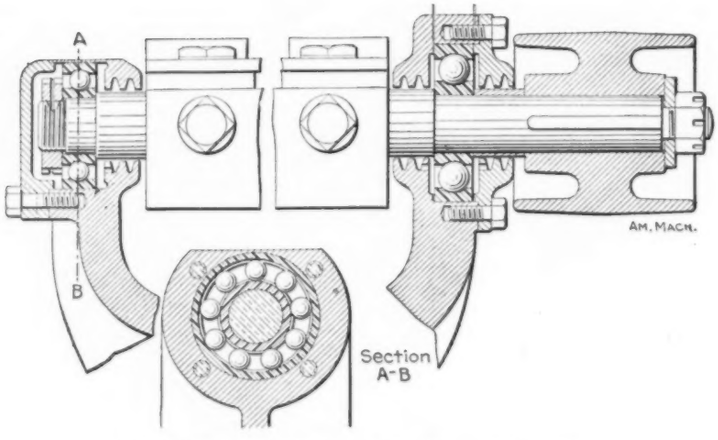


FIG. 3. CUTTER ARBOR FOR JOINTING MACHINE

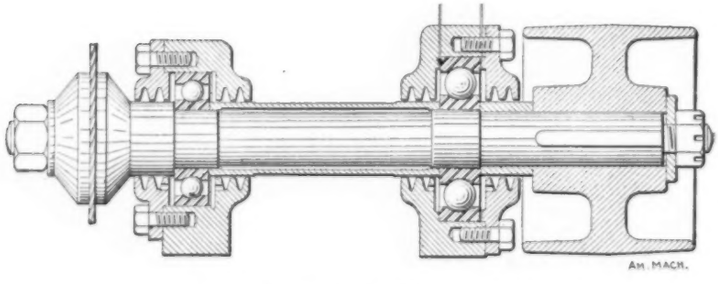


FIG. 6. ARBOR FOR CIRCULAR SAWS

BALL BEARINGS IN WOODWORKING MACHINES

The accompanying illustrations show some typical applications of Hess-Bright ball bearings to woodworking machines.

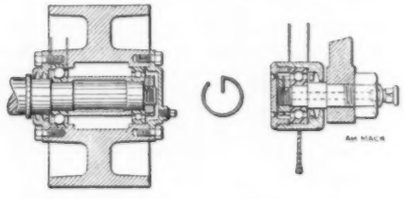
A simple design is that of the molding-machine cutter spindle, Fig. 2. This illustrates the double-grooved closures used wherever a shaft passes through. These have a bore 1/64 inch larger than the shaft diameter, and oil or water reaching the first lip has its movement arrested by capillary action. Oil which gets past the first inner lip is returned by a drain hole to the interior. This drawing shows the method of holding the shaft against endwise motion.

For that purpose the outer race of the right-hand bearing in Fig. 2 is fitted with a very slight side clearance, just sufficient to avoid clamping it. The outer race of the other bearing is left free to move lengthwise, thus allowing for expansion or contraction of the shaft, and for slight errors in machining or assembling. Each outer race is made a "sucking fit" in the housing, which allows it to creep very slowly around, thereby distributing the wear evenly over the entire race groove. Each inner race of each bearing is clamped firmly on the shaft.

The same principles of mounting are applied to the cutter arbor of a jointing machine, Fig. 3. This drawing shows the form of closure where the shaft does not pass through. It also indicates the larger size of bearing chosen where both belt pull and the work of the tool are to be carried.

The guide roll for a band saw, Fig. 4, runs a stationary pin, and the outer end of the closure is covered by a dust-proof cap, in which is a hole for oil. The same grooves and lips as above illustrated are used to confine oil and exclude water and dirt. Fig. 5 shows a smaller roll with one bearing.

Fig. 6 shows the arbor for a circular saw. The inner races are spaced by a sleeve slipped over the arbor proper and are followed first by the pulley, then by a second spacer, the whole thing being clamped by a single nut. As in the previous drawings, one outer race is free to move endwise, and the other is confined with just enough clearance to insure the slow creep above mentioned.



FIGS. 4 AND 5. GUIDE ROLLS FOR BAND SAW

A mounting for a large band saw is shown in Fig. 7. Perfect alinement is insured by the use of the swivel mountings shown.

The mountings for a vertical shaper spindle, Fig. 8, present some interesting features. The weight of the spindle itself is carried by the lowest annular bearing, which in this instance is preferred to the plate-thrust type, because it is not affected by centrifugal force at the very high speeds used. The outer race of the bottom bearing is not clamped, but is allowed to creep slowly around. No provision is made for vertical adjustment of the spindle, since none is required. Throwing the oil is prevented by the various dust and oil shields shown. An ample oil reservoir is provided by suitably inclosing the lower bearings and by the upwardly projecting sleeve surrounding the shaft at the upper bearing.

In marking off a die with sulphate of copper, a machinist was surprised to be asked what he was using and why. He explained, and learned that the man had always used blue chalk, which had resulted from time to time in indistinct lines after handling a few times.

Static Discharges from Wireless Telegraph Station

By J. O. Smith

It is a well known fact that the high-voltage static discharges from the aërial of a wireless-telegraph station are heavy enough to cause considerable sparking on adjacent circuits, such as power, lighting, telephone, etc. A particular case of this kind occurred recently at the works of the Fore River Shipbuilding Company, at Quincy, Mass.

A 2-kilowatt wireless station was installed there, and when the station began operations, trouble on various circuits started all over the shop. Flashes of the static electricity occurred spasmodically, leaping from one wire to another, and fire played around the motors and switchboards. A great deal of this, of course, did no apparent damage, but real loss was occasioned through the burning out of several motors and the suspension of work by the operatives, whose alarm can be readily understood.

The trouble was partially remedied by connecting two electric lamps, in series with each other, across the power mains and grounding their middle connection in the same manner as the ground-detector lamps are installed on a switchboard. This, however, only reduced the trouble. Then high-grade condensers were tried in place of the lamps, and these withstood the high potentials, and the various power and lighting circuits are now practically free from any objectionable conditions.

There is still some annoyance on the telephone lines, loud noises breaking up the conversation whenever the wireless station is in operation, but the telephone wiring is now being put into lead cables, with the idea of ridding it of this trouble.

The New York Shipbuilding Company, at Camden, N. J., also has a 2-kilowatt station working in its yard, but no dangerous or annoying effects have been experienced there. An analysis of the two cases, however, discloses the probable reason for this difference. In the case of the New York Shipbuilding Company the aërial and leads were located at some distance from the power house and lines; in the case of the Fore River Company the main pole lines of power and telephone cables passed quite close to the building containing the wireless station.

This is quite in line with investigations made elsewhere and the separation of wireless-station equipment from power and telephone lines by considerable distances should be adhered to whenever installations of this kind are made.

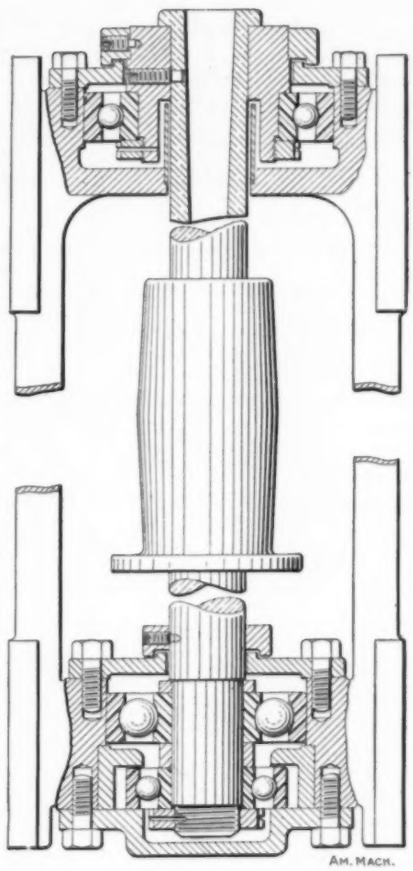


Fig. 8. Mountings for Vertical Shaper Spindle

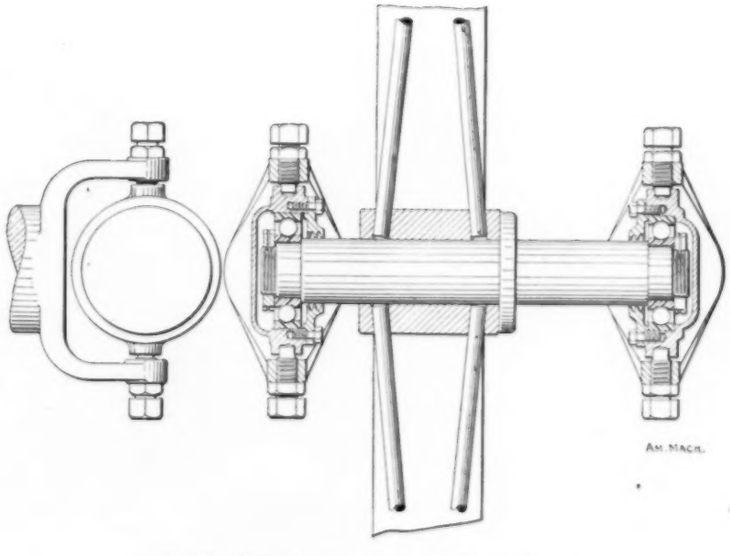
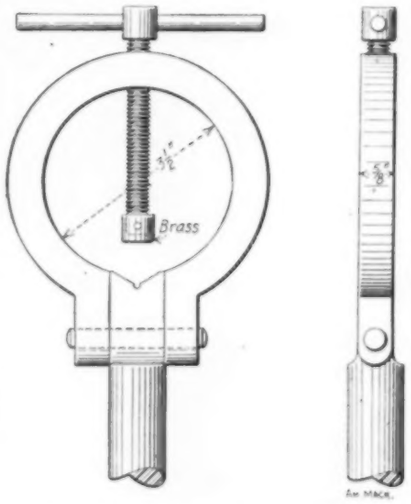


Fig. 7. Mounting for Large Band Saw

A Vise Clamp for Holding Taps, Reamers, etc.

By Arthur Munch

The accompanying figure illustrates a very handy clamp for holding taps, reamers, dies, etc., in a vise so that they can be brought into a position in which they can be worked to the best advantage, the vise being usually too low for this work. The clamp is also very handy for holding round disks, such as threading dies, etc., when drilling.



Vise Clamp for Holding Taps, Reamers, Etc.

The clamp can be put at any angle with the vise and vise jaws, and when the clamp is fixed in the vise, the work can be turned around by loosening the screw by means of the handle on top.

The clamp can be swung out of the way on the pin *A* when light filing is to be done.

I have used two of these clamps for over a year, and would not like to have to get along without them.

While not a new idea, the following may be of interest and use to those not already acquainted with such an application: In a shop with electrical current, two wires can be run to the miller, one of which can be fastened so as to come in contact with the other, and ring a buzzer or bell, just before the time the cut is to run out in the miller, so that constant watching of the operation is unnecessary.

Planers with Reversing Motor Drive

Editorial Correspondence

An interesting form of drive resulting in elimination of belts and pulleys, and securing economy of operation and accuracy of reversal.

The engravings illustrate the Cincinnati Planer Company's planers as equipped with reversing motor drive.

The planer in Fig. 1 is a 48x48-inch by 12-foot machine, operated by an 18-horsepower motor which, like the others illustrated in the different views, is a Triumph adjustable-speed reversible motor. The motor is coupled direct to the driving shaft, which is usually the pulley shaft on the planer. This coupling is dierctly under the shield shown to the left of the motor, and does away with all pulleys, shifting mechanisms, belts and overhead work.

The drive for the 42-inch by 18-foot planer in Fig. 2 is from a 14-horsepower motor placed parallel to the machine in a compact position, and connected by bevel gears with the driving shaft of the planer. Monitor controllers are used on both planers in Figs. 1 and 2, and provision is made in the case of the first machine for a cutting speed ranging from 24 to 60 feet per minute, the speed range on the other planer including rates from 25 to 60 feet on the cut and 50 to 100 feet per minute on the return movement, independent of the cutting speed.

Two different arrangements of controller panels are seen in Figs. 3 and 4, which show respectively a 48-inch by 10-foot planer driven by an 18-horsepower motor and a 72-inch by 24-foot planer with 30 horsepower motor. The cutting speed of the former may be varied from 25 to 60 feet per minute and of the latter from 24 to 60 feet, the return speed of the larger planer being 100 feet per minute.

Westinghouse controllers are used on both of these machines, and the different views illustrate the manner in which the controller panels may be located to meet

FIG. 1. 48x48-INCH BY 12-FOOT PLANER WITH REVERSING MOTOR DRIVE

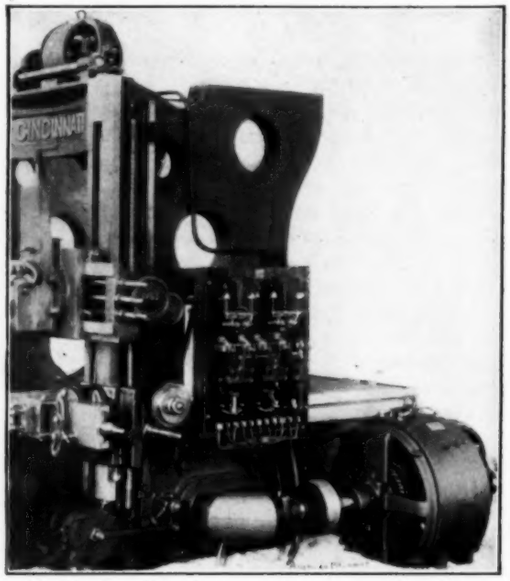


FIG. 2. 42-INCH PLANER WITH REVERSING BEVEL-GEAR DRIVE

FIG. 3.

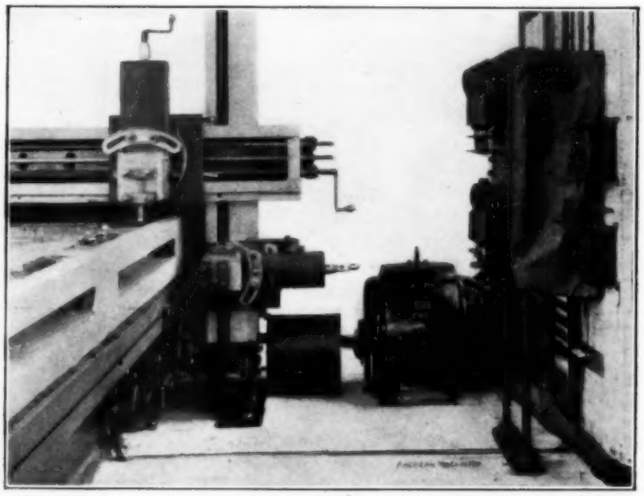


FIG. 4.

TWO OTHER METHODS OF LOCATING CONTROLLERS FOR REVERSING MOTOR DRIVE FOR PLANERS

requirements in different installations. With the form of drive shown in the various views, the motor may be placed either at the right or left side of the planer, to suit conditions.

Referring again to Figs. 1 and 2, it will be seen that on the side of the bed immediately in front of the shifting mechanism there is a transfer switch, which is so connected that the table dogs throw over this switch instead of shifting the belts as they usually do. This changes the direction of the current and the controllers shown on the panel to the right first shut off the current of the motor, then convert the motor into a generator, and this acts as a dynamic brake and the motor comes to a stop as quickly as though some mechanical brake were applied; then it immediately reverses and accelerates to full speed.

Next to the controller panel are two hand controllers; the upper one is for varying the cutting stroke, by which any cutting speed within the range specified can also be varied for any rated speed in the range referred to. After these hand controllers are once set they remain stationary and do not move every time the planer reverses, as the variations are maintained through resistance coils.

This drive enables a motor to be used which is much smaller than is usually applied on top of the machine, simply because there are no large pulleys to gather flywheel inertia, and have to be stopped and reversed in the opposite direction. Consequently there is a reduction in the peak load at reversal, and the current consumption is correspondingly less. Furthermore, there is an absence of noise. There are no belts to maintain and replace and the planer will operate on a short stroke of 5 or 8 inches for hours at a time without heating or extra consumption of power. This drive is particularly adapted to large planers where the gear ratio is high and the pulleys have more flywheel inertia, and it permits a more constant short stroke than could be otherwise obtained where there is stretching and slipping of belts and destruction of belts due to heating of the pulleys.

In place of the usual elevating device on top of the planer, there is a small motor attached with a double-throw switch, one side being used to elevate the rail and the other side for lowering the rail, thus doing away with every belt on the machine.

A new alloy called alherium has been discovered that will have important uses in the art if its characteristics as described in *The Electrician* are correct. This is a new white-metal alloy, lighter than aluminum, its specific gravity being 2.4 to 2.57. A test piece 0.628 inch in diameter gave an elastic limit of 33,712 pounds per square inch, an ultimate strength of 41,798 pounds per square inch, an extension of 17.5 per cent. on 2 inches and a reduction of 39.1 per cent. This alloy gives sound castings, rolls and turns well, and can be soldered, forged and welded. It is claimed that it does not tarnish or corrode and withstands the action of the water.

Analysis of Processes 79 Years Ago

By A. Hamilton Church

The main principles involved in the analysis of processes have been known from the early beginnings of manufacturing industry. The celebrated economist, Adam Smith, writing in the third quarter of the eighteenth century, pointed out the advantages to be gained by subdivision of processes and enumerated three principal features: The increase of dexterity brought about by the workman's specializing his work; the saving of time in changing from one class of work to another; the possibility of evolving special tools for labor saving.

To these principles Charles Babbage, writing in 1832, added another; namely, "that the manufacturer by dividing the work into different processes, each requiring different degrees of skill or of force, can purchase exactly that precise quantity of both necessary for each process." He further explains this by the statement that if the whole of a process capable of subdivision be executed by a single operative, he "must have sufficient skill to perform the most difficult and sufficient strength to execute the most laborious of the operations into which the work can otherwise be subdivided." And from these considerations there arises an important practical point stated by Babbage in these terms: "The higher the skill required of the workman in any one (subdivision of a) process and the smaller the time during which it (the special skill) is exerted, the greater the advantage of separating that process from the rest and devoting one person's attention to it."

So far from the analysis of processes being a new idea, the whole history of manufacturing is saturated with it, so much so that it would be impossible to believe that such an important method has ever been wholly lost sight of. The work of Babbage already referred to merely reflected the knowledge and practice of his day. No one who cares to explore the early records of manufacturing can fail to be convinced that our most advanced modern methods have introduced very little that is new in principle, though naturally there has been considerable practical adaptation to changing needs and conditions.

Space does not permit reproducing many of the interesting illustrations of advanced methods known to those who in an industrial sense may be termed "the ancient." But Babbage's illustration of the manufacture of the common pin as carried on in his day before the perfection of automatic machinery will serve to prove that modern methods are a natural evolution and not a revolutionary discovery at all.

Process Study in Manufacturing Pins

Seven main processes were concerned in the making for pins, from the straightening of the wire to the "papering" of the finished pin. A fairly complete scientific analysis had evidently been applied to pin making even in those remote days, for our author gives a tabular statement of these processes in which the following data are worked out:

(1) The time occupied in processing the equivalent of one pound of pins, expressed in decimals of an hour for each process.

(2) The wages cost of each process for one pound of pins in decimals of a penny.

(3) The cost price of making each part of a single pin in millionths of a penny.

Further, as showing the minute study of details which has always been an inseparable part of intelligent *manufacturing* (as apart from *making*) the following operation schedule of process 5a of the art of pin making may be given:

Pins Process 5a—"The operator with his left hand dips the pointed end of the body of a pin into a tray of heads; having passed the point through one of them, he carries it to the other end with the forefinger. He now takes the pin in the right hand and places the head in the cavity of the stake and lifting the die with his foot allows it to fall on the head. The blow tightens the head on the shank which is then turned round and the head receives three or four blows on different parts of its circumference." The pay is 1/6 (36 cents) per 20,000 heads. A skilful operator can with great exertion do 20,000 per day,; 1 per cent. are spoiled. The die has to be repaired after 30 pounds of pins have passed through it.

That these minute studies were not made without an aim is obvious. Babbage remarks that the object of knowing the cost of separate processes is to find when and where it pays to exercise inventive skill. "If," he says, "a quarter of the time taken to fix on the heads of pins were saved the cost of finished pins would be reduced by 13 per cent. On the other hand, a saving of even one-half the time taken to spin the coil of wire would scarcely have any appreciable effect on the finished cost." No better example of logical reasoning based on the close ascertainment of facts can be found today. The whole story of the pins is worthy of being pondered even in the fiercest light of modern advanced systems of management.

A Peculiar Combination of Cams

By William C. Glass

Designing machinery in the present advanced state of the art consists, for the most part, in the grouping of many of the old and well known mechanisms and mechanical motions in such a manner as to produce a certain result, and occasionally it happens that the designer evolves a peculiar combination which commends itself to the mechanical world without regard to the particular work for which the machine was designed. Without attempting, therefore, to describe the machine of which the mechanism herewith illustrated forms a part, I wish to direct attention to the novel arrangement of cams for moving the ends of the grippers *A*, Fig. 1, in the paths shown.

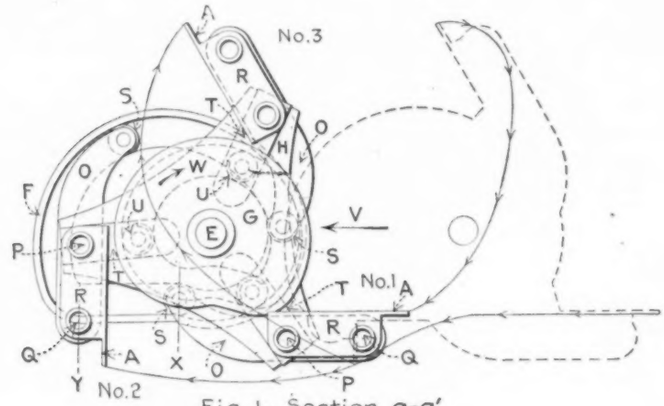


Fig.1. Section a-a'

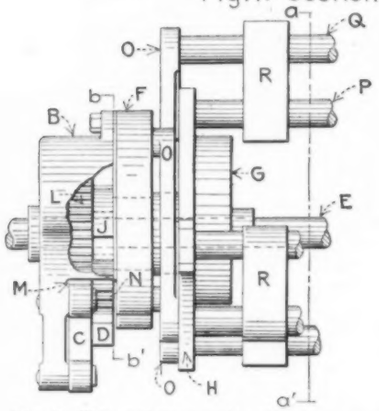


Fig.2. Elevation partly broken away

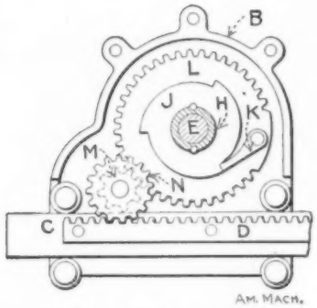


Fig.3. Section b-b'

A Peculiar Combination of Cams

Fig. 2 is an elevation shown partly in section and partly broken away. Fig. 3 is a section on line *b b'* of Fig. 2. Fig. 1 is a section on line *a a'* of Fig. 2. For the sake of clearness, the views are somewhat diagrammatical.

Bracket *B* is adapted to slide on side bar *C* to which rack *D* is secured. Shaft *E* is keyed in bracket *B*. Cam *F* is fast to bracket *B* and is thus held rigid with relation to shaft *E*. Cam *G* is keyed directly on the shaft. The spider *H* is mounted on shaft *E* so that it can rotate, and has fast to it the three-pointed ratchet *J*. Ratchet *J* is adapted to be engaged by pawl *K* on gear *L*. Gear *L*, which has its bearing on the shaft, meshes with pinion *M*, which in turn is fast to pinion *N* meshing with rack *D*. The arms *O* carry at one end the tubular shafts *P* and *Q* which support the gripper brackets *R*, and at the other end the cam rolls *S* running in cam *F*. Each of the slots in the spider *H* is fitted with a sliding block *T*. Blocks *T* are provided at one end with cam rolls *U* running in cam *G* and are adapted at the other end to receive an end of tubes *P*.

By means of a connecting rod, not shown, the shaft *E* is reciprocated through a distance of eight inches. The working stroke is in the direction of arrow *V*, and is just sufficient to rotate the spider one-third of a turn in the direction of arrow *W*. On the return stroke, the pawl rides back over the ratchet to engage the next tooth.

It is the motion from the position occupied by gripper No. 1 to that occupied by gripper No. 2 that is most important, and the problem was to make the gripper move in a straight line parallel to the side bar *C* through a distance of approximately 6 inches, but at the end of the stroke it must occupy the position of No. 2. The second part of the problem, which is self explanatory, is that gripper No. 3 must stand at an angle of 120 degrees with relation to No. 1. Each gripper will in turn, occupy the position and perform the function of each of the others, it taking three strokes to return it to its initial position. As the way of getting the six inches of straight-line motion may not be clear from a mere inspection of the illustrations, a word of explanation will not be amiss.

The straight part of the cam *F* from line *X* to *Y* is three inches long and parallel to side bar *C*. As the roll *S* (gripper No. 1) is traveling from *X* to *Y*, the roll *U* on block *T* is traveling in cam *G* in a path of such shape that the radial motion of the block is timed with its circular motion so that the resultant is a straight-line motion, parallel to the straight part of cam *F*, imparted to the tube held in the opposite end of the block. It is thus readily apparent that if two points on arm *O* (centers of roll *S* and tube *P*) move in a straight line parallel to the side bar, gripper No. 1 will have the desired straight-line motion. In order to rotate the spider enough to cause the roll *S* to move from *X* to *Y* it is necessary to move the bracket *B* along the side bar three inches. Thus the total straight-line motion of the gripper will be six inches, or the length of the straight part of cam *F*, plus the amount necessary to move the whole mechanism along the side bare to cause the roll *S* to travel over this straight part of the cam.

This mechanism has been operating successfully.

The matter of rates, divisions of rates and allowances on inbound and outbound traffic moving over short lines of railroad serving iron and steel industries in official classification territory has for some time been under consideration by the Interstate Commerce Commission. This has more particular reference to that portion of the territory lying east of Cleveland and Cincinnati, O. The commission has now ordered that a proceeding or investigation shall be instituted in the matter, and that all railroads in official classification territory reaching points in the territory mentioned at which steel and iron industries are operated shall become the subject of investigations to be conducted with a view of ascertaining the relation of the short lines of railroad to and their affiliation with the iron and steel industries which they serve, and for the purpose of determining whether the divisions of rates received by or allowances made to them are unduly preferential or otherwise unlawful. Hearings will be held at times and places to be hereafter designated.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

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Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For July,* 1911 *(American weekly, American monthly, English weekly and German weekly), total,* 111,250.

Of this issue 22,750.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 145

American Machinist

Lubrication of Machinery Bearings

What are the relative efficiencies of various methods of lubricating machinery bearings? This question suggests a phase of the problem of lubrication that has received altogether too little consideration in spite of the extensive discussion that has been given to the broad subject of friction and lubrication of bearings.

The condition of lubrication that should be aimed at in all bearings is what is commonly termed perfect lubrication, for it is by far the most efficient. That is, a condition where a film of oil is established and maintained so that the journals are actually fluid borne. Here there is no metal-to-metal contact; not only is metallic friction eliminated, but metallic wear and tear as well, except during the brief periods of starting and stopping.

This phenomenon of a journal floating on a film of lubricant was demonstrated many years ago by Beauchamp Tower in a series of experiments reported to the British Institution of Mechanical Engineers in 1883. Those experiments are now historic. They laid the basis for a thorough understanding of the principles of lubrication. Yet the application of those principles as worked out in practical devices have made but little progress with the exception of a few lines of machinery, notably electrical apparatus.

Tower showed that the oil film between a rotating journal and its mating bearing was under considerable pressure dependent upon the unit load. He further demonstrated that profuse lubrication and uniform lubrication were the two essentials if journal friction was to be reduced to a minimum. When planning his investigations he saw the need of obtaining a uniform degree and quality of lubrication in his experimental bearings, and after trial adopted the oil bath; later experiments demonstrated this to be the best practical method to use. Note the following:

"The oil bath probably represents the most perfect lubrication possible, and the limit beyond which friction cannot be reduced by lubrication."

To determine the relative efficiency of three methods of lubricating he experimented under conditions as nearly uniform as possible with an oil bath, a siphon lubricator and felt pad placed beneath the journal. The results set these three methods in the following order of efficiency: Oil bath, pad under journal, siphon lubricator, with the comparative friction represented by the numbers 1, 6.5, 7. That is, lubrication from a pad under the journal increased the friction 6½ times over the friction for the same journal and bearing under identical conditions of loading but lubricated from an oil bath. Similarly, the friction of the bearing when lubricated with a siphon lubricator was seven times greater than when lubricated from the bath. The oil used was rape oil.

Other investigators have found similar results though varying slightly in degree. Stated broadly, the friction of a journal bearing lubricated in such a manner as to establish a perfect film of oil is only from 1/10 to ⅙ of the corresponding value when lubricated by ordinary methods.

The difference lies between *profuse* and *scanty* lubrication.

Let us turn for a moment to the usual forms of supplying oil to rotating bearings. The open oil hole and oil cup are very familiar to us. Both give a condition of lubrication having a factor of friction some seven times greater than it would be under the best of conditions. Pad lubrication is a little better, but is not extensively used except in railway practice. The commoner methods of supplying oil in quantities sufficient to establish a perfect oil film are ring oiling, flooded lubrication and forced lubrication; all three are used extensively in electrical apparatus and power-generating machinery, but very little outside of these two fields. It is probable that a well designed ring-oiling bearing runs under conditions very closely approximating those produced by an oil bath in which the journal dips. Flooded and forced lubricating systems are specially designed to provide a profuse quantity of oil, in the first case under low pressure, in the second under considerable pressure. These methods have had only a limited application by machine-tool builders.

Two objections may be urged. The first is an increased cost of the machine, due to the elaboration of the lubricating devices. While this initial cost would exist it should be more than offset by savings from decreased wear and tear on journals and bearings, from reduced power losses in friction and from lessened attendance. This last saving appears to be of considerable importance, for the more highly developed lubricating systems need only occasional inspection, while the more common forms need daily care.

A second objection is somewhat more serious. It is evident that if oil is recirculated through a bearing the danger of washing dirt and grit into the space between the bearing surfaces is greater than if fresh, clean oil is fed through an oil hole or from an oil cup, allowed to do its work and then go to waste. Thus these devices demand most careful designing in order to preclude the entrance of grit that might be washed into the bearings to their serious detriment. However, the experience of the builders of electrical machinery indicates that there are no grave difficulties in developing such designs.

It appears that much more efficient oiling devices might be used on many lines of machinery than are now employed.

The Immediate Need in Aviation

We have called attention before to the need for an engineering study of the problems and mechanisms of aviation, to furnish a basis for true progress. A review of the developments of the past two years shows but little advancement that is worth recording. The catering to the popular demand for exhibitions is a retarding, not a stimulating influence. Yet much progress must be made before the aëroplane will enter into the service of man to the extent that now is only promise.

To further emphasize the present need, we are glad to quote an opinion of Professor Ennis, found in an article on this

subject in the current issue of the *Engineering Magazine:*

"Aërial flight in machines heavier than air has justified its claim upon engineering attention in less than 10 years. The study of physical laws and the experiments made by Langley, Chanute, and others, in the face of great discouragement and at no small cost in time and money, have formed the basis of progress which some of these men have not lived to see. Their work, of permanent solidity, may perhaps require further elaboration; but the immediate need in the development of aviation is a need for the engineer. Spectacular flights are profitable to those who fly, and thrilling to the multitude, but what is now demanded is a rapid evolution of the art to the point where any man may fly who wants to, and where every man may use the aëroplane with as much certainty as he does the telephone. To accomplish this, the problems of design must be approached by designers rather than sportsmen, and a knowledge of material and mechanics must replace that type of inventive genius which learns by killing someone."

Looking After the Drilling Operations

Drilling is such a common shop operation that we are apt to think that any old way of holding the work is good enough. The pressure of the drill on the work tends to hold it in place but unless it is firmly clamped to prevent twisting or springing, it is impossible to get the best results from the drill.

When the drill has a small feed such as we formerly used, a little springing is not of much consequence, but when it is walking through metal at ten turns to the inch, turning out chips that would do credit to a lathe, any vibration detracts from its efficiency and the desired results do not materialize.

The springing of parts of the driller, which allows a variation in the rate of feed, or "jumps" the drill point when it strikes a soft spot or a blow-hole, also reduces the amount of work and adds to the cost of drills.

And then the grinding.

All drill makers know the trouble, the blame that is laid on their shoulder, because drills do not give satisfaction, when the whole fault is often one of sharpening. Even the machines built for the purpose are not always used so as to give a free-cutting drill, which is such an important point if good work is to be done economically and satisfactorily.

This is one of the points where a little careful study will result in considerable saving in our shops and one that is often overlooked because it is so common. It does not take a very large shop to make it profitable for the care of drills to be in the hands of one man, who can make a study of the question and can watch results closely.

The German Technical Museum

In other columns we present an article describing the founding and growth of the great German National Technical Museum, at Munich. This is one of the greatest museums of applied art and industry in the world, and is one of which the German people may be justly proud.

Though located in the Bavarian capital, it is far from being a local enterprise, as is shown by the many sources from which it draws funds. These include the German Imperial government, the governments of several of the German states, many engineering and manufacturers' organizations and private individuals. Likewise, its board of administrative control is selected from a number of representative sources, including appointments by the German chancellor and the Prussian government.

It has been the purpose to make this great museum the cornerstone of scientific history and technical knowledge and advancement. Thus it is used to supplement instruction given in the technical universities by presenting technical history marked out within the logical limits of its various stages of development.

That it is popular is shown by the number of visitors during the years 1909-1910, namely, 313,000.

We have pointed out in these columns the scope of the museum which is beginning to take shape in Washington in connection with the work of the Smithsonian Institution, an American Museum of National Arts and Industries. Let us hope that in time it may be a worthy rival of this great German institution.

Personals

E. P. Larkin has become associated with the United States Metal Products Company, College Point, N. Y.

Henry L. Barton, vice-president of the Metal Products Company, Detroit, Mich., has accepted a position with the General Motors Company, of the same city.

T. Elliott Payson, formerly superintendent of the Edengraph Manufacturing Company, New York City, is now with the Lansden Company, Newark, N. J.

A. E. Newton, secretary, Prentice Brothers Company, Worcester, Mass., sailed on August 9, on the "Lusitania," for a six weeks' business trip in Europe.

E. H. Curtis, Jr., formerly superintendent of construction of the Pittsburg Plate Glass Company, has established a mechanical engineer's office at Norwood, Ohio.

H. H. Maxfield, until recently master mechanic of the Pennsylvania railroad shops, at Trenton, N. J., has been transferred to the Pittsburg shops of the same company.

Robert E. Hall, until recently assistant manager of Francis Brothers & Jellett, Inc., Philadelphia, Penn., has become vice-president and treasurer of the Goulds Manufacturing Company, Boston, Mass.

O. C. Thompson has accepted a position as mechanical engineer with the Healy Box Corporation, New York City. Mr. Thompson was formerly works manager of the National Wire Box Company, South Bend, Ind.

F. B. DeGress, for over 10 years New York district manager of the Crocker-Wheeler Company, has resigned from that company to assume the position of general sales manager of the Pulsometer Company, New York City.

Clarence E. Buxton has resigned his position as superintendent of the James Cunningham Company, Rochester, N. Y., to accept a position in the automobile plant of the American Locomotive Company, at Providence, R. I.

F. Nehrbas, formerly production superintendent of the E. R. Thomas Motor Company, Buffalo, N. Y., has resigned in order to accept a position as manager of the automobile plant of the American Locomotive Company, at Providence, R. I.

Ashley P. Peck, for six years identified with Allis-Chalmers Company, as sales engineer, connected with its New York office, has recently associated himself with the Terry Steam Turbine Company, as district sales manager for the Middle West, with offices in the People's Gas building, Chicago, Ill.

E. M. Herr, at a recent meeting of the board of directors of the Westinghouse Electric and Manufacturing Company, was elected president, succeeding Edwin F. Atkins, who declined reëlection. Mr. Herr has been first vice-president, in charge of operation, since 1905. Previous to Mr. Herr's connection with the Westinghouse interests, he was prominently connected with several of the important railroad companies in various mechanical capacities.

Albert Bettesworth, machinist, living at 418 Summerville avenue, Philadelphia, Penn., has been missing since June 2, when he left Philadelphia to seek employment in some other city. He has worked in the employ of the Wheeling Mold and Foundry Company, Harrison Safety Boiler Works, and the Midvale Steel Company. He is 21 years old, 5 feet 7 inches in hight, and weighs about 135 pounds. His complexion is fair, and he has brown eyes and light, wavy hair. Information concerning his whereabouts is earnestly requested by his cousin, Herbert Norton, 418 Summerville avenue, Philadelphia, Penn., with whom he made his home.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Portable Driller, Miller and Boring Machine

The accompanying halftone shows a heavy portable driller, miller and boring machine that is flexible in its operation and especially adapted for electrical works, locomotive works and similar plants.

The diameter of the spindle is 5 inches, length of feed 32 inches, minimum distance from center of spindle to base 25 inches, maximum distance from center of spindle to base 68 inches; the spindle sleeve is 6¾ inches in diameter and has a bearing 27⅜ inches long in capped bearings. The spindle speeds range from 3.56 to 35 revolutions per minute when driven by a G. E. type CR10-10-horsepower motor running at 450 to 1350 revolutions per minute and there are four changes of geared feeds running from 0.0177 inch to 0.0709 inch per revolution of spindle. The spindle is fitted with a No. 6 Morse taper with retaining drift key slots arranged to drive the cutters by means of a broad-face key. The feed is obtained by means of a steel rack and the drive is by means of a bronze worm wheel, 12¾ inches outside diameter, and a hardened-steel worm fitted with roller thrust bearings, both incased for continual lubrication.

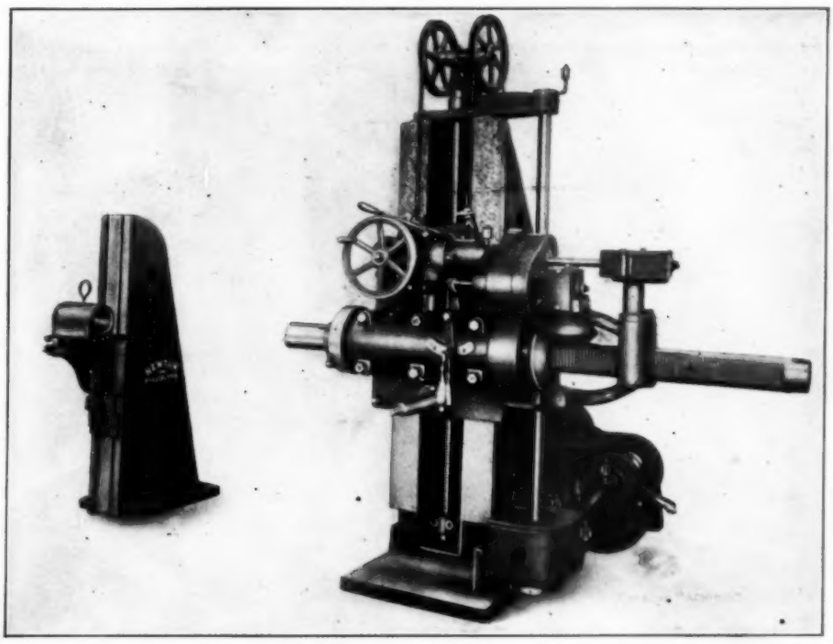
A special provision to prevent the escape of oil from this box is bushings that revolve with the shaft, as otherwise the oil would escape through the splines in the vertical driving shaft.

The face of the upright is 26 inches wide, length of spindle-saddle bearing on the upright is 26 inches and the width of the bearing is 20 inches. The spindle saddle is counterweighted and has hand elevation only, although the elevating screw has a top and bottom bearing. The base of the upright is 28x46 inches. The spindle is furnished with a thrust binder in front of the flange on the spindle and also with a binding bolt to engage the rack sleeve to prevent any movement when milling or facing.

The machine is furnished with improved type of facing arms on which it is possible to obtain in and out movements to the tool slides by means of a star feed and there are 10 inches of in and out feed and the maximum distance from the center of the tool post to the center of the spindle is 18 inches.

The motor, while not shown in the photograph, is mounted on a pedestal in the rear of the machine and the drive to the spindle is either direct or through approximately three to one back gears.

The machine is made by the Newton Machine Tool Works, Philadelphia, Penn.

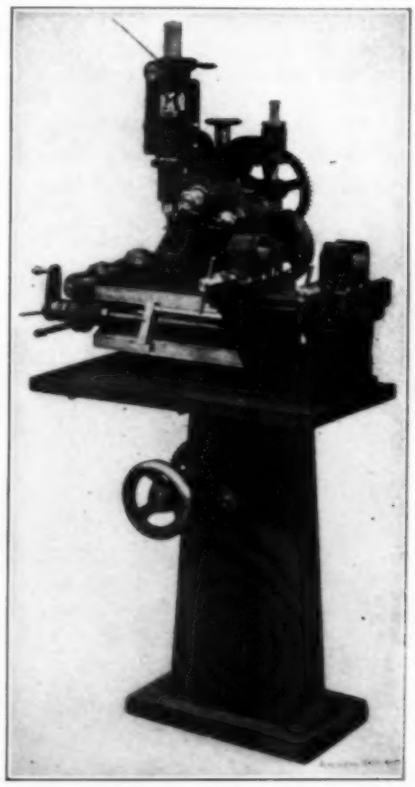


PORTABLE DRILLER, MILLER AND BORING MACHINE

Spline Miller

The halftone illustrates a new high- and low-speed spline miller recently placed on the market by the Berghausen Machine Company, Cincinnati, O.

The jaws are independent of one another, closing and opening by right- and left-handed screws, allowing the work to be keywayed to be of different diameters. The work is placed in the jaws, and the cutter having been placed in position, the head is lowered by a screw, the handle of which has a micrometer



SPLINE MILLER

dial by which depth of cut is controlled. The length of cut is adjusted by an automatic stopping device consisting of a rod directly under the jaws. The power feed clutch is seen at the end of the feed screw.

The machine will cut keyways up to ½ inch, of standard depth, and up to 12 inches in length, in shafting from ½ inch to 3 inches in diameter. The speed of the cut is ¾ inch and 1 inch per minute.

A vertical end mill is provided for rounding out the ends of the keyway, which is accomplished by lowering the end mill to required depth, the mill being kept in position by clamping the upper sleeve of the spline. The same feed used for the keyway cutter is used for horizontal cut of end mill, by either hand or power.

A cutter for the Woodruff key has also been provided as shown by the first cutter to the right in the halftone. This cutter is held in the collet, which is lowered and raised by same device that operates the regular cutter.

The machine is also made for belt drive, and is provided with oiling device for cutter, shifting levers and gear guards, not shown in the illustration.

Rotary-Planer Cutter-Grinder

The rotary-planer cutter-grinder shown in Fig. 1 has been designed for grinding the cutters in place in the machine.

The grinding attachment consists of an arm *A*, Fig. 2, in which is carried the grinding-wheel spindle. This arm is pivoted at *B* and caused to oscillate by the finger *C* engaging the tools *D* successively while the head is rotating. This finger *C* is attached to the arm *E*, on which is fitted a crank plate by which the length of movement to the spindle arm *A* is obtained. As the tools rotate, the finger *C* is raised and the arm *A* in turn forced under the tool, giving the angle of clearance. To finish the side of the tool, the arm *F* is engaged. This causes the partial rotation of the shaft *B*, in which is milled a helical spiral slot and a pin in the arm *A*, engaging into this spiral slot, causes the side motion of arm *A*. This side motion is obtained also from the operation of finger *C*, and, of course, the mechanism for driving the front clearance is then disengaged.

There is provided side adjustment to the saddle for properly locating the emery wheel and the whole grinding attachment is mounted on a support, as shown, and driven by a ½-horsepower motor having a speed of about 2500 revolutions per minute. This grinding attachment can be furnished for any style or shape of machine; the only specification necessary is the distance from the center of the cutter head to the top of the surface upon which this attachment is to be mounted.

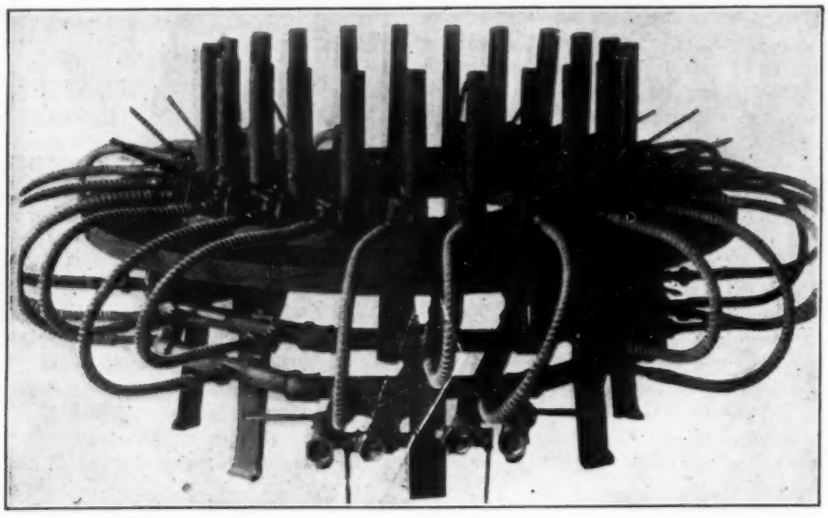
The machine shown is a recent development of the Newton Machine Tool Works, Philadelphia, Penn.

Tire Heater

The apparatus shown in the accompanying halftone has been designed primarily as an automobile-tire heater, although it should be adaptable for use in connection with the setting of the rims of built-up gears and similar work.

The appliance is adapted for work of any diameter up to 42 inches and any width up to 14 inches, by means of adjustments. The burner employed is of new design, proof against back fire or blow out.

The apparatus is a recent product of the Improved Appliance Company, 456 Kent avenue, Brooklyn, N. Y.



TIRE HEATER ADAPTABLE FOR BUILT-UP GEAR RIMS, ETC.

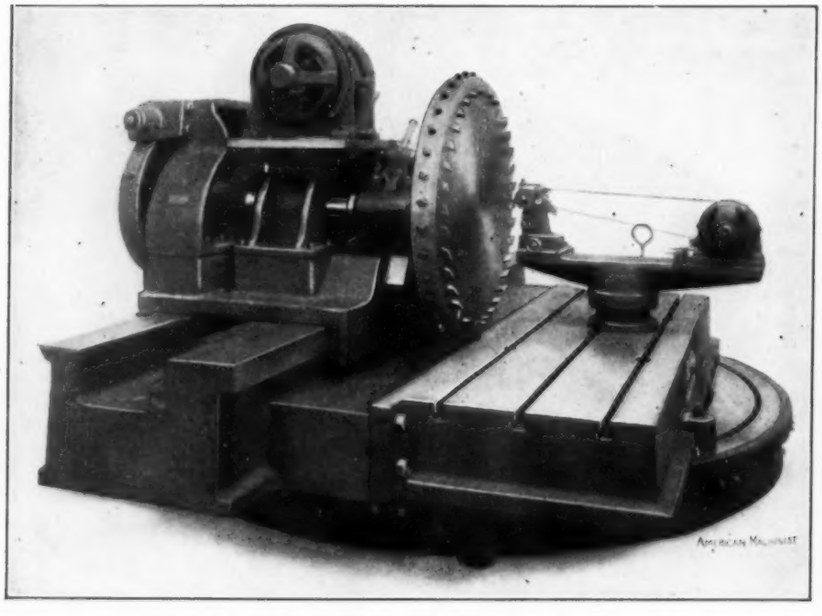


FIG. 1. ROTARY-PLANER CUTTER-GRINDER

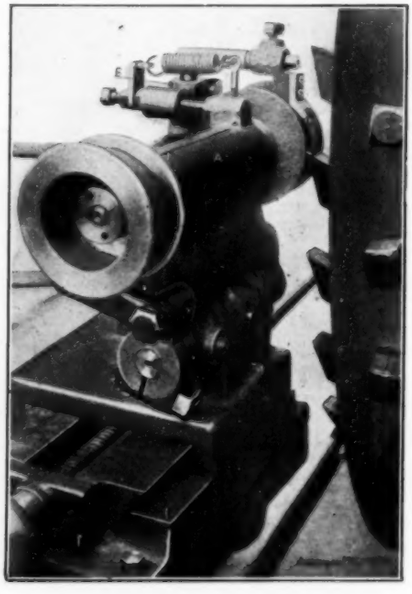


FIG. 2. GRINDING ATTACHMENT

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

Chadwick & Trefethen, Portsmouth, N. H., will erect concrete machine shop.

The Woonsocket Wagon Manufacturing Company is about to rebuild factory.

The Shoe Hardware Company, Waterbury, Conn., is making plans for an addition to the factory.

B. W. Decatur, Springfield, Mass., has been granted permit to erect blacksmith and tinsmith shop.

Hart & Cooley Manufacturing Company, New Britain, have awarded contract for addition to factory.

The Boston Gear Works, Norfolk Downs, Mass., is in the market for two engines and one turret lathe.

MIDDLE STATES

William Scherer, 1384 East Fortieth street, Cleveland, O., will erect a foundry.

Mr. Romadka, of Milwaukee, Wis., will erect a modern foundry at Bismark, N. D.

The metal-working plant of Jackson & Co., Philadelphia, Penn., was destroyed by fire.

The Toledo Computing Scale Company, Toledo, O., has plans out for a new modern plant.

The Grafton (Wis.) Iron Foundry, owned by Neutzloff Brothers, was burned. Loss, $40,000.

The National Boat and Engine Company is planning to build a boat factory at Shell Lake, Wis.

The Standard Aluminum Company, Two Rivers, Wis., will erect a three-story factory building.

L. Schalter, 1900 West Twenty-eighth street, Cleveland, O., has been issued a permit for a garage.

The Ohio Wire and Steel Company will locate in Warren, O., to manufacture drawn wire, flyscreen and wire cloth.

The Secret Boat Works will move its factory from Bay City to Port Huron, Mich., and is planning improvements.

The Park Drop Forge Company, Cleveland, O., making automobile forgings, has doubled capital and will enlarge plant.

A. R. Mosler & Co., of New York, have filed plans for a factory to manufacture safes and automobile supplies in Yonkers, N. Y.

The Perfection Spring Company, Cleveland, O., manufacturers of springs and auto motors, has let a contract for a factory building.

The Canners Can Company, 4840-46 South Western avenue, Chicago, Ill., has started a $200,000 brick factory and will install new machinery.

The American Radiator Company has secured a permit for the erection of a $25,000 factory at 1741 Elmwood avenue, Buffalo, N. Y.

A garage to cost $4700 will be built by Fisher & Scull, contractors, on Chestnut street, west of Fifty-second street, Philadelphia, Penn.

The Ferro Machine and Foundry Company has taken out a permit for a new building at 6641 Hubbard avenue, Cleveland, O., to cost $15,000.

R. D. Coy, 5130-36 Lake avenue, Chicago, Ill., has commenced a $10,000 brick garage to do custom repairs and will equip it with tools for the same.

The Cadillac Auto Company, of Detroit, will erect a building in Dayton, O., to be used for salesroom and garage and it will be equipped with modern machinery.

The Bolster Brazing and Machine Company is opening and equipping a shop at 602 Water street, Baltimore, Md., and is to carry on a brazing, welding and machine-work business.

The Overland Automobile Company, Toledo, O., is erecting a large new addition to its plant. Considerable space will be used in the manufacture of automobiles, clocks and speedometers.

The Indiana Iron and Steel Company, Linton, Ind., has been incorporated by M. K. Frank, J. D. Karasik, Algernon Granville and others; to manufacture iron goods. Capital, $150,000.

The Standard Manufacturing Company, Peru, Ind., has let contracts for new buildings which will add 144,000 feet of floor space to its already large plant. New machinery will be purchased.

The Wire Specialty and Machine Works, South Bend, Ind., has been incorporated with a capital of $40,000 by Gerald Mahoney, Marion Campbell and Thorvald Hansen; to do a manufacturing business.

The Indiana Die Casting and Development Company, Indianapolis, Ind., has been incorporated to manufacture die-casting machines, by E. E. Gates, J. L. Baker and W. P. Herrod. Capital, $100,000.

The Bingham Manufacturing Company, 227 Prospect avenue, Cleveland, O., will build a large factory in the near future and will need additional equipment. They manufacture the Bingham compensating carbureter.

The Abbott Motor Company, Detroit, Mich., will open a factory branch in that city for the display of its models and as a service station for the care of its cars. Machine and other equipment will be needed.

A syndicate has been formed in Detroit, Mich., to manufacture the Stattley coin-sorting machine and will start operations shortly. Joseph Boyer, J. L. Hudson and Homer Warren, trustee, are at the head of the company.

The plant of the Darlington Foundry and Machine Company, Darlington, Penn., is reported to have been bought by Pittsburg people and will immediately be enlarged. It will then be operated as a steel-casting plant. New furnaces are to be erected and employment given to 200 men.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids covering items as follows: Under schedule 3820, two automatic turret machines and one automatic screw machine on August 29; under schedule 3829, 2100 pounds sheet brass, 600 feet brass tubing on September 12; under schedule 3828, on the same date, miscellaneous quantities of hack-saw blades, galvanized iron or steel buckets, emery cloth, twist drills, steel figures and letters, hammers, hardware, tools, etc., 7-ton hydraulic jacks, deck-hand lanterns, pad locks, semi-finish steel nuts, reamers, wood screws, taps and dies, pipe wrenches and spare parts; under schedule 3827, 8000 gallons mineral oil; under schedules 3820 and 3826, miscellaneous quantities of brass pipe, sewer pipe, wrought-iron or steel pipe, copper tubing, composition valves.

WEST OF THE MISSISSIPPI

Nels P. Brown, of Atlantic, Ia., will build a 25x100 blacksmith shop.

The Fairmont (Minn.) Machine Company will erect a fireproof machine shop.

The boat-building plant of R. J. Crescenzi, San Francisco, Cal., was destroyed by fire.

Edwin M. Fiske, Santa Monica, Cal., contemplates the erection of a plant for the manufacture of aëroplanes.

The Portland (Ore.) Sheet Metal Works has acquired a new site on the east side, and plans for the erection of a new plant.

The Santa Fe Railroad, Los Angeles, Cal., is having plans prepared for a 44-stall roundhouse to be erected at Barstow, Cal.

The Solar Electric Engineering and Manufacturing Company, San Francisco, Cal., has been incorporated by H. B. Winters and A. P. Dron.

C. W. Metcalf, San Diego, Cal., has organized a company with a capital of $100,000, to establish a plant for the manufacture of patented acetylene gas-making machines.

The Rotary Air Brake Company has been incorporated at Phoenix, Ariz., with a capital of $1,000,000 by A. E. Stevens and H. C. Steele, etc. Head offices of the company will be at Phoenix.

The Kittle Manufacturing Company, Los Angeles, Cal., will establish a plant for the manufacture of motor-cycle parts, and for automobile and machine-repair work. F. C. Kittle is head of this company.

Estimates for construction of the new railroad shops at Tucson, Ariz., for the Southern Pacific Railroad, have been sent to New York for approval. A liberal appropriation has been made for this work.

CANADA

The Bain Wagon Company will build a factory at Woodstock, Ont.

The Atlas Motor Company will build a new plant at Brockville, Ont.

The Pacific Electric Heating Company will locate a plant in Vancouver, B. C.

T. C. Sealey is to equip a large garage and repair shop on Bold street, Hamilton, Ont.

The Otis Fensom Elevator Company, aHmilton, Ont., contemplates building a large addition.

The J. H. Ashdown Hardware Company, Winnipeg, Can., will build a branch plant at Regina.

It is reported that the Grand Trunk Railway will equip large work shops at Cape Rouge, Quebec.

The Nelson garage and repair shops will be completely equipped at 2055 Dufferin street, Montreal, Can.

The Sweet Machinery and Foundry Company, North Bay, Can., will locate a large branch factory at Cobalt, Ont.

The Preston Woodworking and Machinery Company, Preston, Can., is to make additions calculated to double its capacity.

General Manufacturing

NEW ENGLAND

Chicopee, Mass., contemplates extending its sewer system.

Proctor Academy, Andover, Vt., will install power equipment.

H. E. Stanton, Huntington, Mass., will install small waterwheel.

O. P. Berry, Wolfboro, N. H., is making additions to his power plant.

Athol, Mass., will build a new reservoir to increase its water supply.

Walter Baker & Co., Boston, Mass., will install new boiler-house equipment.

Walter M. Lowney, Mansfield, Mass., will install new power-house equipment.

The Plymouth Rubber Company is building a new factory at Canton, Mass.

William Sim, Cliftondale, Mass., is in the market for a horizontal tubular boiler.

C. W. Smith & Son, Waterboro, Me., contemplate installing steam power plant.

The Royal Typewriter Company, Hartford, Conn., will install boiler and accessories.

The city of Lawrence, Mass., will buy a 3,000,000-gallon turbine-driven centrifugal pump.

The Dexter Yarn Company, Pawtucket, R. I., has plans drawn for new power-house equipment.

The Byron Weston Company, Dalton, Mass., will install a large electric motor in one of its mills.

The Bradford Yarn Mills, Warren, Mass., will install a large gasolene engine for motive power of its mills.

The Felters Company, manufacturers of felt, Millbury, Mass., is building two additions to its plant.

The factory of the Eastern Paper Box Company, Manchester, Conn., was destroyed by fire. Loss, $12,000.

The Atherton shops at Lowell, Mass., manufacturers of textiles, are being enlarged and equipment will be needed.

J. B. Martin & Co., Taftsville, Conn., have awarded a contract for the erection of $10,000 addition to their plant.

The Hoosac Cotton Company, North Adams, Mass., will erect a new spinning mill in addition to its present plant.

The New York, New Haven & Hartford Railroad has awarded contract for construction of boiler house at Worcester, Mass.

Charles Vaninetti, Lee, Mass., is erecting a building to be equipped for the manufacture of concrete blocks, brick and cornice work.

The elevator or coal-lifting machine valued at $6000 was destroyed by fire in the coal sheds of Daniel Doherty, Dorchester, Mass.

Joseph Massack will build an addition to his wood-turning factory on Terryville road, Bristol, Conn., which will double its capacity.

The Hamilton Manufacturing Company, of Lowell, Mass., has filed plans for a mammoth mill to be erected between buildings owned by the Appleton company and No. 5 mill of the Hamilton plant.

The Greene Paper Company, Philadelphia, Penn., manufacturers of tissue paper, contemplates moving its plant at Lambertville, N. J., to Westfield, Mass. The Springdale mill will be secured for the plant.

MIDDLE STATES

The City Railway Company, of Dayton, O., will enlarge its car house.

The United Refrigerator Company will erect a $30,000 plant at Kenosha, Wis.

Justin L. Means, Merrill, Wis., will install an excelsior and box factory at Edgar, Wis.

The Citizens Electric Light, Heat and Power Company, of Dayton, O., will enlarge its plant.

A boiler and engine house is to be built at Colver, Penn., for the Evansburg Coal Company.

American Stove Company, Cleveland, O., has purchased land for the erection of a new warehouse.

R. H. Corney Company, Camden, N. J., will build a new boiler house and install two new boilers.

The Iroquois Brewing Company, Buffalo, N. Y., will erect an $1800 cooperage shop at 67 Iroquois place.

The Kramer Manufacturing Company, New Jersey and Merrill streets, Indianapolis, Ind., will install a new boiler.

The Aetna Paper Company, of Dayton, O., will enlarge its plant. The building will be two stories, 80x116 feet.

The Welf Brothers Shoe Company, Columbus, O., has increased its capital and will make additions to factory equipment.

The Edgar (Wis.) Veneer and Manufacturing Company will install machinery equipment. John Matthews, general manager.

The Wisconsin River Paper and Pulp Company, Stevens Point, Wis., will build a new brick power plant and install new boilers.

The Warsaw Overall Company, Warsaw, Ind., has been incorporated with a capital of $10,000 by W. S. Felkner, W. W. Reed and C. H. Ker.

Power-plant equipment will be required for the amusement park to be erected for Clarence Slater, Lorain, O. It will be known as Slater's Grove.

The Smith Chemical Company will move from Columbus, O., to Indianapolis, Ind., where it is at present erecting a very large fertilizer-manufacturing plant.

The Illinois-Dayton Oil and Gas Company, of Dayton, O., was incorporated for the purpose of developing an oilfield in Illinois. The capital is given as $50,000.

Considerable machinery was damaged or destroyed in a $4500 fire that burned the plant of the Capitol City Dye Works, 134 North Lake avenue, Albany, N. Y.

The Oaktown Gas Company, Oaktown, Ind., hsa been incorporated with a capital of $6000 by W. J. Walker, J. F. Stoelting and T. E. Salter, to manufacture and distribute artificial gas.

It is reported that the Security Reliner Company, of Montgomery, N. Y., which was recently incorporated with $50,000 capital, will erect a factory for manufacturing automobile tires.

The Majestic Knitting Company, Logansport, Ind., has been incorporated with a capital of $50,000 to manufacture knit clothing. Directors, E. S. Rice, J. H. Foley, O. H. Binns and others.

Harry Loeper, proprietor of the Waverly Ice Company, has secured a tract of ground on the Philadelphia & Westchester Railway, between Thomas and Whitby avenues, Philadelphia, Penn., on which an ice plant is to be erected.

Power-plant equipment and ice-making machinery will be required for the $150,000 eight-story hotel to be erected for Joseph Laronge, Williamson building, Cleveland, O. George Breibel, architect, Cleveland, is completing plans.

SOUTHERN STATES

Announcement has been made by the management of the General Electric Porcelain Company, that the pottery at New Cumberland, W. Va., will be doubled in capacity, and high-potential electric parts will be confined to this property. Machinery is ordered from the office in New Jersey. The improvements will cost about $10,000 and the number of employees will be about doubled.

WEST OF THE MISSISSIPPI

Mr. Wood's lathe mill at Brainerd, Minn., was destroyed by fire.

Hoops & Bostleman, Superior, Neb., will erect a gate factory.

The city of Bremerton, Wash., is planning to install a new sewerage system.

The city of Willits, Cal., contemplates the installation of a waterworks system.

The Bell Telephone Company, Plains, Mont., will install a new plant in this district.

The Flagstaff (Ariz.) Lumber Company will build a large box-manufacturing plant.

The town of Superior, Ariz., will install a waterworks system and pumping plant.

The National Peat Products and Chemical Company will erect a plant at East Clinton, Ia.

The Pacific Fish Company, Monterey, Cal., will build an addition to its fish-canning plant.

The city of Anaheim, Cal., will build an addition to its municipal electric-lighting plant.

Marsh McDiarmid, Hemet, Cal., contemplates the installation of new pumping plants.

The Wienecke-Horr Canning Company, Dubuque, Ia., was destroyed by fire. Loss, $40,000.

The Spahr & Rose Lumber Company, of Dubuque, Ia., was damaged by fire. Loss, $50,000.

S. C. Goff, Minam, Ore., will build a new sawmill plant. Modern machinery will be installed.

P. Gabraig, Tropico, Cal., is having plans prepared for a commercial garage and repair shop.

The Board of Water Commissioners, San Bernardino, Cal., will install new pumping machinery.

The Deming (N. M.) Light and Power Company is planning for the erection of a large power plant.

The Baker Iron Works, Los Angeles, Cal., will build a boiler-shop addition to its iron-working plant.

The city of Oxnard, Cal., is having plans prepared for a new sewerage system in the Bagnall district.

The city of Wapato, Wash., will install a new sewerage system. About $17,000 will be expended.

The Planada Development Company, Los Angeles, Cal., will install a large pumping plant at Planada.

The city of Artesia, Cal., contemplates the

installation of a sewerage system. A bond issue will be voted.

The plant of the Montana Street Mill Company, Seattle, Wash., was destroyed by fire. Loss, $80,000.

The Cascade Montana Flouring Mill Company will double its capacity. New machinery will be installed.

George L. Hepburn, Los Angeles, Cal., door manufacturer, has taken out a permit to erect a new plant.

The council of Algona, Ia., have voted $18,000 for additional machinery in the electric light and water plants.

The city of Long Beach, Cal., is planning to install a new sewer system. Bonds for $350,000 will be voted.

The Holton Power Company, El Centro, Cal., will increase the capacity of its ice and refrigerating plant.

The Wenatchee (Wash.) Valley Orchards Company will install a large pumping plant on the Wenatchee river.

The Kretschner Manufacturing Company's plant at Dubuque, Ia., was destroyed by fire. Estimated loss, $100,000.

The Universal Oil Company, Lost Hills, near Bakersfield, Cal., is plannnig to install new oil-drilling machinery.

The North Side School, Glasgow, Mont., will build an addition to its boiler plant and install new equipment.

The city of Lemoore, Cal., will install a new sewerage system. Olmstead & Gillelen, engineers, Los Angeles, Cal.

The National Lumber Company, Los Angeles, Cal., has taken out a permit to build an addition to its mill.

George H. Savage, Chicago, Ill., will organize a company and build a glass-manufacturing plant at Portland, Ore.

The Northern Manufacturing Company, Waterloo, Ia., will erect a refrigerator factory, 130x65, on Bluff street.

The Midway Northern Oil Company, Midway field, near Bakersfield, Cal., will install new rotary drilling equipment.

L. Gustave, Seattle, Wash., is at Skowl Arm, Prince of Wales island, Alaska, and will build a fish-canning plant.

The City Water Board, Portland, Ore., plans to install water meters throughout the city. Estimated cost, $300,000.

In connection with its proposed waterworks systems, the city of Dorris, Cal., will install an electric-pumping plant.

The city trustees, Chico, Cal., contemplate the installation of an electrolier lighting system in the business district.

The Standard Oil Company is planning for the erection of a large distributing and pumping plant at Winnemucca, Nev.

Wertz, Good & Olson, fish canners, contemplate the erection of a clam- and salmon-canning plant at South Bend, Wash.

Phoenix Waste Manufacturing Company, Galveston, Tex., has organized with $40,000 capital to manufacture cotton waste.

L. G. Patterson, Cashmere, Wash., is having plans prepared for a fruit-packing plant. Modern equipment will be installed.

The Chehalis Lumber Company, Littell, Wash., will install new machinery in its mill; the capacity will be increased.

The Bay State Milling Company's plant at Winona, Minn., was destroyed by fire. A new million-dollar plant is proposed.

The Girard Manufacturing Company, Los Angeles, Cal., has taken out a permit to build a new machine shop at Lacy street.

The State Board of Control, Olympia, Wash., will install a new power plant at the Veterans' Home, Port Orchard, Wash.

The Montana Central Elevator Company, Conrad, Mont., is planning for the erection of a new grain elevator at Williams, Mont.

The Consolidated Lumber Company, Wilmington (Los Angeles), Cal., has taken out a permit to build an addition to its mill.

John Collins, Wrangell, Alaska, contemplates the erection of a salmon-canning plant at Fish Egg Harbor, Southeastern Alaska.

The Pomona (Cal.) Fruit Growers' Association will build an addition to its fruit-packing house. New machinery will be installed.

S. A. Hassam, North Yakima, Wash., operating a concrete-pipe factory, is planning for the erection of a new plant at Prosser, Wash.

The Portland (Ore.) Fertilizer Company contemplates the erection of a garbage-disposal plant. Modern machinery will be installed.

The Victoria Citrus Association, Riverside, Cal., will build an addition to its fruit-packing plant. New machinery will be installed.

The Las Cruces (N. M.) Electric Light and Ice Company will increase the capacity of its plant. New machinery will be installed.

The logging machinery and lumber plant of the Curtiss Lumber Company, near Mill City, Ore., was destroyed by fire. Loss, $40,000.

The lumber-mill plant of the Montana Lumber Mill Company, Seattle, Wash., was destroyed by fire. Total loss estimated at $80,000.

The lumber mill plant of the Booth-Kelly Lumber Company, Springfield, Ore., was totally destroyed by fire. Loss estimated at $250,000.

The Montezuma Oil Company, near Sentinel, Ariz., will soon install new oil-drilling machinery. Col. W. F. Cody is head of this company.

The Spalding Ranch, near Willows, Cal., will install new pumping machinery for irrigation work. M. A. Knock is in charge of this work.

The Central Door and Lumber Company, Portland, Ore., has acquired a site on Holgate street and plans for the erection of a new plant.

The flour-milling plant of the Wasco Warehouse and Milling Company, The Dalles, Ore., was destroyed by fire. Loss estimated at $50,000.

The Ensign-Baker Asphalt Refinery, Hadley, near Santa Maria, Cal., will increase the capacity of its plant. New machinery will be installed.

The Los Angeles (Cal.) Gas and Electric Company has taken out a permit to make improvements and extensions in its steam-power plant.

MINING

The Bishop Creek mine, near Bishop, Cal., will build a new milling plant.

The Southern Eureka Mining Company, Amador, Cal., will install a new milling plant.

The Arcaivada Consolidated Mining Company, Cima, Cal., will install new operating machinery.

The Bushman mine, near Twain, Cal., is planning to increase the capacity of its 10-stamp mill.

F. C. Tatum, operating near Alamos, Sonora, Mex., plans for the erection of a milling plant.

The New York-Arizona mine, near Morenci, Ariz., will build a cyanide addition to its milling plant.

The Independence mines, Telegraph Pass, near Phoenix, Ariz., contemplate the erection of a stamp mill.

The Ozark Mining and Milling Company, Magdalena, N. M., contemplates the erection of a milling plant.

Frank Dudek, operating tungsten mines, near Yucca, Ariz., contemplates the erection of a concentrating plant.

The Tungsten King mine, near Deer Park, Wash., will increase the capacity of its milling plant to 40 tons daily.

The Summit Copper Company, near Miami, Ariz., contemplates the erection of a 500-ton dry-concentrating plant.

South Amador Mines Company, Jackson, Cal., is preparing to install a 12-drill camp. J. J. McSoily, superintendent.

The Baltic mine, near Randsburg, Cal., will install new operating machinery. Judge Wynn is head of this property.

The Sonora & Santa Cruz Reduction Company, near Patagonia, Ariz., contemplates the erection of a new concentrator plant.

The Anaconda Copper Mining Company, Butte, Mont., plans for the installation of two large compressed-air hoisting plants.

The Blue Gouge mines, near Placerville, Cal., plan for the erection of a 20-stamp mill. F. E. Ware is head of this property.

The Campo Seco (Cal.) Smelter will install new machinery, including roaster, reverberator and smoke-condensing equipment.

The South Jackson Gold Mining Company, Jackson, Cal., is contemplating a compressor and hoist installation. W. P. Miller, superintendent.

The Copper Queen Gold Mining Company, near Mayer, Ariz., will install new electric machinery for operation. A milling plant is contemplated.

The Western Durango Mining and Development Company, Durango, Mex., is planning for the erection of a cyanide plant. A concession has been granted.

The Standard Oil Company is said to be planning for the erection of a smelting plant, in opposition to the American Smelting and Refining Company, near Orient, Wash.

The Yellowstone mine, near Mill City, Nev., contemplates the erection of a new mill in the near future. Becker & Johnson, Winnemucca, Nev., are head of this property.

The Skipper Gold Mining and Milling Company, near Magalia, Cal., recently incorporated, is planning to install a new milling plant. C. L. Browning is interested in this company.

The Vanadium mines, near Cutter, N. M., will install a new reduction plant for vanadium ores. About $75,000 will be expended. W. A. Benitz is manager of this company.

The Keystone Mining Company, of Shamokin, Penn., operating in the Talalapa district, Jalisco, Mex., contemplates the erection of a smelting plant. W. H. Childs is general manager.

The Bismarck Consolidated Mines Company, Black Hills district, S. D., is said to be planning for the erection of a 300-ton milling plant; this is to be increased later to double the capacity.

The Goldfield (Nev.) Deep Mines Company has been incorporated with a capital of $10,000,000 by J. Ross Clark, of the Salt Lake Railroad, and others. The company will operate in deep-mining work, heretofore unknown in Nevada, and install machinery for such operation. Reduction plants in this district are contemplated.

Business Items

The Ruggles-Coles Engineering Company, New York City, has taken over practically the exclusive sale in the United States and Canada of "Monel" metal, a product of the Bayonne Casting Company.

In order to secure additional manufacturing facilities, to meet the demands of increased business, the Brown Instrument Company, Philadelphia, Penn., has assumed control of the Keystone Electrical Instrument Company, Philadelphia, Penn., and the shops and laboratories of both companies are to be combined. Richard P. Brown has become president of the Keystone Electrical Instrument Company.

The location of the western office of the J. S. Bretz Company, of New York, has been changed to 504 Ford building, Detroit, Mich., where J. W. Hertzler, its western representative, will make his headquarters. A full sample line of F. & S. ball bearings, German steel balls, Star ball retainers, U. & H. master magnetos, Bowden wire mechanism, Hartford universal joints and clutches, and drop forgings will be displayed there.

Trade Catalogs

Pratt & Whitney Company, Hartford, Conn. Small tools catalog. Illustrated, 248 pages, 4½x7½ inches.

Rhineland Machine Works Company, New York City. Catalog. Ball bearings. Illustrated, 39 pages, 9x11½ inches.

The Browning Engineering Company, Cleveland, Ohio. Locomotive cranes. Catalog. Illustrated, 55 pages, 9x12 inches.

The Watson-Stillman Company, New York City. Hydraulic pumps and accessories. Illustrated, 120 pages, 6x9 inches.

The Acme Machine Tool Company, Cincinnati, Ohio. Catalog. Turret machinery. Illustrated, 17 pages, 8½x11 inches.

The Hess-Bright Manufacturing Company, Philadelphia, Penn. Catalog. Ball-bearing hangers. Illustrated, 32 pages, 6x9 inches.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Thomas meter installations and tests. Bulletin, illustrated, 16 pages, 5x8 inches.

Forthcoming Meetings

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association: regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania: monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Welles tools. Welles Caliper Co., Milwaukee, Wis.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for inventor's Handbook.

Offered thirty thousand dollars of profitable work more than we can handle; need practical man with five thousand cash. "Profit," AM. M.

Specialties to manufacture; uptodate brass foundry and machine shop; automatic machinery, etc. Edward Schroeder Lamp Works, Jersey City, N. J.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Wanted—One second-hand, 500-volt, 50-kilowatt, compound-wound, belt-driven generator; give full particulars and net price. Box 180, AMERICAN MACHINIST.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Patents—An able mechanical engineer will see and protect technical points better; valuable suggestions and assistance in developing inventions. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

We have hundreds of steel disks, 3¼ and 3½ diameter, ¼, 3/16, ⅛ inch thick, annealed; this is Crucible Steel Company's sheet tool steel; it is a by-product in the manufacture of rotary paper knives. Samuel M. Langston, Camden, N. J.

Wanted—Party or parties to buy the Canadian manufacturing right of one of the most uptodate machines in the way of a store fixture that was ever invented, now being manufactured and sold in the United States. Box 198, AMERICAN MACHINIST.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraph Company, Baltimore, Md.

Wanted—Second hand electric, overhead traveling crane, 40-foot span, main hoist 35 feet lift; no auxiliary needed; suitable fot handling clam shell bucket of one and one-half cubic yards capacity; current to be alternating, 220 volts, 3 phase, 60 cycles. Address Box 138, Anderson, S. C.

Peck's "Sure" center finder goes on tailstock center of lathe and finds drills and countersinks a center in work held and revolving in lathe chuck; made in four sizes, drill diameters ¼, 5/64, 1/16 and 3/64 inches; by mail postpaid on receipt of 65c. each size. W. A. Peck, 141 Brewery St., New Haven, Conn.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Pierce Manufacturing Company, Woonsocket, R. I.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—Superintendent for machine shops, boiler shop, foundry and pattern shop manufacturing high grade engines and boilers; must be familiar with uptodate methods; state age, experience and salary expected. Box 195, AMERICAN MACHINIST.

ILLINOIS

Wanted—Foreman for radiator machine shop; pleasant town; steady position. Answer, stating experience and salary expected. Box 193, AMERICAN MACHINIST.

Wanted—A first class assembler and adjuster on small complicated mechanism; must be an all-around mechanic with executive ability, capable of taking charge of our assembling department after learning our work; state age, experience and last four places employed; location, Chicago. Box 154, AM. MA.

Wanted—Salesman to sell a leading brand of high speed and carbon steels; one who has a thorough working knowledge of such steels and is able to demonstrate them, is required; a man familiar with the Northern States of the Middle West is preferred. Write, giving particulars of age, salary expected, experience, etc., to Box 157, AMERICAN MACHINIST.

INDIANA

Wanted—A few skilled toolmakers by a well established manufacturing firm, located in Indiana; applicants must be of high character and enterprising in their work; state character of work best skilled in, age, experience and give references. Box 170, AM. MACH.

Wanted—We employ Cleveland and Brown & Sharpe automatic turret forming machines, Potter & Johnston and Jones & Lamson turret lathe, also automatic gear cutting machines; we want a man skilled in the operation of some or all of the above, who is thoroughly qualified to operate and superintend to best advantage. Address, stating age, experience and give references. Link-Belt Company, Indianapolis, Ind.

IOWA

Wanted—Machine shop foreman; must be competent in building pneumatic machines; state age, experience, salary wanted, whether married, etc. Box 155, AMER. MACHINIST.

Wanted—General superintendent, capable of taking complete charge of thriving and fast growing factory making general line of steel stampings; location in good mid-western city; runs about thirty punch presses, with full supplemental equipment, employs seventy operatives; must be first class executive, good disciplinarian, able to handle labor, and to turn out the work; only thoroughly equipped and experienced man need apply; place demands a good man and will pay for him, but wants full value received; no beginners or failures wanted, but the chance of a lifetime for the right man; state fully and clearly your qualifications, experience, age and salary desired; all will be held strictly confidential. Address "X," Box 50, AM. MA.

KENTUCKY

The Universal Stenotype Company, Owensboro, Ky., organizing factory for production of writing machine, requires services of toolmakers, die makers, machinists, screw machine men and punch press men; only applications from mechanics having best of refer-

ences will be considered; young men preferred; fine opportunity for rapid advancement; state what salary expected. Address "Superintendent," enclosing references.

MARYLAND

Wanted—Toolmaker familiar with subpress, die and jig work; must be capable of handling tool department. Box 191, AMER. MACHINIST.

MASSACHUSETTS

Draftsman for printing machinery; good position for man of ability and experience as designer. Address Box 206, AMER. MACH.

Wanted—One special mechanic (machinist) at $4 per diem; a competitive examination will be held August 21, 1911, for the purpose of filling the above position. For further information address "Commandant," Navy Yard, Boston, Mass.

NEW JERSEY

Wanted—Two experienced draftsmen for permanent position. Write or apply in person, Safety Insulated Wire & Cable Co., Bayonne, N. J.

Wanted—Toolmakers, Jones & Lamson and Gisholt operators, and general machine tool hands; good pay, steady employment; mail application, giving wages at last place. Crane Motor Car Company, 96 West Seventh Street, Bayonne, N. J.

Draftsman wanted for general machine work, and with experience in designing machine tools; able to work quickly from instructions or sketches; give full particulars of experience; also age and salary required. Box 182, AMERICAN MACHINIST.

NEW YORK

Wanted—Time clerk and cost keeper; must be quick and accurate; good opportunity for advancement if competent. Box 205, AM. MA.

Wanted—Good detailer and tracer; must be quick and accurate; state references, experience and salary expected. Box 203, AM. M.

Wanted—First class layoutman and inspector; must be competent, quick and reliable; good opportunity for right party; state experience and wages expected. Address Box 202, AMERICAN MACHINIST.

Wanted—A first class demonstrator with high speed steels; must understand tempering and be an all-around machinist and tool room man; write, stating experience and salary required. Box 187, AMERICAN MACHINIST.

Wanted—Several first class bench hands on machine tools and special machinery, also first class horizontal boring machine operator; permanent position and good opportunity for advancement if competent. Box 204, AMERICAN MACHINIST.

Wanted—Salesmen to sell a leading brand of high speed and carbon steels; must have a thorough knowledge of the working of such steels and be able to demonstrate them if required. Write, giving particulars, age, salary expected, experience and territory covered, to Box 192, AMERICAN MACHINIST.

Foreman Wanted—For shop in central New York, employing 18 to 20 machinists, on general light and heavy work; must be familiar with modern methods and standards, and able to suggest and assist in the designing of machinery; state age, experience and wages expected. Box 186, AMERICAN MACHINIST.

Wanted—Machinery salesman, live and energetic, with theoretical and practical experience in gear cutting, for selling high grade, well known line of modern gear cutting machines; first class opportunity for capable hustler; state age, salary desired, former experience and territory covered; only men with thorough experience in gear cutting line will be considered. "S. G.," AMER. MACHINIST.

OHIO

One lathe, planer and radial drill machinist wanted. Box 181, AMERICAN MACHINIST.

Wanted—First class draftsman familiar with designing planers and boring mills. The Cincinnati Planer Co., Cincinnati, O.

Wanted—Communication with competent makers of steel castings, for engagement as superintendent of a proposed steel foundry; fine prospects; state experience and give references. Address, "Davidson," AMER. MACH.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 208, AMERICAN MACHINIST.

Wanted—First class Jones & Lamson turret lathe hand; must be capable of designing special holders. Box 207, AMER. MACH.

Wanted—First class shaper hand for 24-inch Gould & Eberhardt shaper; also first class milling machine hand and grinder operator for No. 2 Cincinnati plain milling machine; men for above positions must be able to do any work within range of machines. Write to Fraser C. McLellan, shop foreman, American Sheet and Tin Plate Co., Monessen, Penn.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WASHINGTON

Wanted—An assistant foreman, young and uptodate, who understands sawmill and engine work, to have charge of floor and bench hands; from 15 to 30 men under him; good job for the right man. Address, Sumner Iron Works, Everett, Wash.

WISCONSIN

Wanted—General foreman and department foremen for machine shop (400 men) in modern works manufacturing automobile parts; applicants with mechanical and executive experience on interchangeable and repetition work, using uptodate equipment, will be considered; state age and experience. Box 174, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Mechanical draftsman, 29, college graduate, naturalized American, with 2½ years shop and seven years designing and checking experience in various lines of machine building, especially fine and automatic machinery, desires change; office or shop; location, Canada or United States. Box 162, AMER. MACH.

CONNECTICUT

Expert tool designer, six years' varied practical experience, capable taking charge. Address "Designer," General Delivery, Hartford, Conn.

Wanted—A position as foreman of turret lathe department, or to take charge of small machine shop; can give good reference as to experience, etc. Box 215, AMER. MACHINIST.

Foreign sales manager, American, with eleven years' selling experience in Europe, speaking French and German, wishes to make connection with manufacturer as foreign sales manager or representative, located abroad; special experience in machinery and kindred lines. Box 216, AMERICAN MACHINIST.

Has some large manufacturing concern an opening for an experienced high-grade general manager or superintendent? I am a good organizer, systematic and uptodate on tools and modern methods; am capable of producing the highest grade work at the lowest cost; best of references furnished as regards character, ability and experience. Box 168, AM. M.

ILLINOIS

First class draftsman in receipt of good education with layout experience wishes suitable position by manufacturer building elevating or contractors' equipment. S. Bray, 516 Lincoln Park Blvd., Chicago.

INDIANA

A-1 all-around mechanic, toolmaker and tool designer, college graduate, executive and competent, inventive ability, wants position as foreman, master mechanic or superintendent; age 35; at present chief tool designer. Box 213, AMERICAN MACHINIST.

MASSACHUSETTS

Practical mechanic, expert designer of tools and special machinery, with extensive experience and executive ability, desires responsible position. Box 214, AMERICAN MACHINIST.

General superintendent by practical man who is holding a similar position in one of the largest machinery manufacturing plants in New England, employing fourteen hundred men; personal interview requested; best of references furnished. Box 200, AM. MACH.

Young man, American, with 15 years' experience as foreman and superintendent on high grade, interchangeable manufacture in uptodate shops, desires position; best references furnished showing successful management, etc., in positions filled. Box 212, AM. M.

NEW JERSEY

Experienced engineer and designer, expert on shop practice, cost system, etc., wishes responsible position with first class concern. Box 171, AMERICAN MACHINIST.

Mechanical draftsman, eight years' experience with automatic machinery, seeks situation to gain wider knowledge; seven years in present position. Box 194, AMER. MACHINIST.

Efficiency engineer, conversant with theory of uptodate efficiency methods and their practical application, in responsible position, desires change. Box 152, AMER. MACHINIST.

Mechanical engineer, college graduate, one year shop, seven years' drafting experience, mostly presses and automatic machinery; also hoisting and experimental work, desires change. Box 188, AMERICAN MACHINIST.

Draftsman, experienced on the design, erection and operation of suction gas producers and gas engines, from 6 to 150 horsepower, desires position; graduate in mechanical-electrical engineering. Box 158, AMER. MACH.

NEW YORK

First class, all-around metal patternmaker desires steady position; would go anywhere. Box 183, AMERICAN MACHINIST.

First class mechanical engineer, with broad experience in designing, manufacturing and erection, wants position. Box 197, AM. MA.

Wanted—General foreman or foreman's position by a first-class, uptodate, all-around machinist, 16 years' experience as foreman. Box 210, AMERICAN MACHINIST.

Wanted—Superintendency by a thorough, uptodate mechanic, executive and producer, in automobile or any kind of machine factory. Box 209, AMERICAN MACHINIST.

A class designing draftsman, paper folding, feeding and cutting machinery, wire stitching folders a specialty, is open for engagement. Box 184, AMERICAN MACHINIST.

A class draftsman and designer, year's experience in development of ideas, designing of automatic and intricate machinery, New York City or vicinity. Box 185, AM. MACH.

Draftsman (22), technically educated, four years' shop, one year's drafting room experience, wants position in big concern with hope for advancement; good references. Box 178, AMERICAN MACHINIST.

Gas engineer-machinist, age 23, five years' experience installing, repairing and operating gas engines, open for engagement August 15; stationary operating preferred; best references. Box 166, AMERICAN MACHINIST.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Position as foreman designer on tools, jigs and fixtures, or automobile engine and transmission; have had over ten years' practical experience and understand pattern, machine and foundry work thoroughly. Box 211, AMERICAN MACHINIST.

Position as works manager or superintendent by first class man of 18 years' experience; thoroughly familiar with time study methods and use of high speed steels; expert in designing tools, fixtures, punches and dies for interchangeable manufacture. Box 189, AMERICAN MACHINIST.

Production engineer desires to make change; uptodate on high-speed steel speeds and feeds, understands piecework and premium system; wishes to connect with factory that desires to increase their output at a minimum cost; will accept position as general foreman or assistant superintendent; now employed; will furnish reference; ex-speed boss. Box 196, AM. M.

OHIO

Assistant superintendent desires to change to higher class proposition; 17 years' experience (executive) small to medium-size accurate work, thoroughly experienced on costs, systematizing and designing of tools; at present over 600 employees. Box 199, AM. MA.

Has 20 years' experience as designing engineer, chief draftsman and superintendent, splendid record originating and developing new ideas, simplifying and improving old designs, thus keeping product uptodate; available to manufacturer wanting high grade man; now employed. Box 175, AMER. MACHINIST.

TEXAS

Wanted—Employment by mechanical draftsman and engineer; eight years' experience. Box 201, AMERICAN MACHINIST.

WEST VIRGINIA

Situation Wanted—Salesman, machinery or mechanical goods, by an energetic man with 11 years' shop and drafting experience; good appearance and education; any territory. Box 148, AMERICAN MACHINIST.

WISCONSIN

Designer and engineer, graduate mechanical engineer, age 34, expert on inventing and developing medium weight, automatic, also fine machinery, typewriters, adding machines, etc., exceptionally capable and successful on practical design of new machinery on a manufacturing basis; will consider similar position. Box 190, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

Years ago, when electric drive in machine shops was a distinct innovation and therefore regarded with suspicion by many of the old timers, a young mechanical engineer, recently graduated from the university, came to his father one evening, as the latter sat reading by the sitting room lamp. "Dad," he said, "here is an advertisement of a concern offering to install its motors on trial, with the understanding that they will be removed and the shafting put back where they found it, at their expense, if the saving in power isn't equal to what they claim. You know what I've been telling you about the adtages of electric drive, and here's a good chance to try out the system without running any risk."

"Maybe you're right," said the old man, who was superintendent of a large machinery-building plant; but I don't believe we want to make any changes just now. Besides, I never pay any attention to the advertisements of those electrical men. The claims they make are so exaggerated that you can't trust them."

"They're not exaggerated," replied the young engineer. "I wish you'd occasionally give me credit for knowing something. While I didn't take the electrical course at the university, I saw enough of motor-drive during our last two class trips to show me what it's good for; and I tell you that you can make a big saving with it."

The old man thought a moment.

"Well, anyway," he said, "we haven't got the power, and I'm not going to put in a new dynamo just to try out this fad of yours."

"You don't need a new generator," rejoined his son. "That lighting set in the engine room is plenty big enough to carry the load for one of the galleries, and you can try the scheme there. The lamps won't be needed again until winter and you've got plenty of time between now and then."

"But how do I know that we can trust this concern you're talking about," the father once more remonstrated. "Once we get those motors in we'll have a hard time getting them out if they don't give satisfaction."

"No, you won't," said the son. "The people who advertise in the AMERICAN MACHINIST are all right; they've got to make good in what they promise or they wouldn't be in business very long. You've bought a good many machine tools that you first saw advertised here, haven't you?"

"Yes," replied the old man, "but this is different. I don't take much stock in guarantees for these new fangled systems that some one is continually bringing out—"

"How are they going to get people like you to try anything if they don't talk strong and make guarantees," broke in the boy impatiently. "Aren't you always bragging about how Edwin Reynolds got his first new type of Corliss engine started by putting it in a mill at Manitowoc or Sheboygan, or somewhere up that way, and guaranteeing that it would save its cost in fuel?"

The old man saw the point and, after some further arguing to save his self respect, consented to recommend putting in motors for a trial, which was the same thing as ordering them, as he always had his way. The motors came and stayed. Most of them are still in the shop, with a host of others. They are holding on, because of their ability to stand up to heavy overloads, when perhaps later designs would now give more economical service. At any rate, they distinctly "made good."

Before long the old man was bragging everywhere about his new system, and incidently about his son, but no one ever heard him mention the advertisement. The report of the conversation above came to us from the boy himself.

But a new factor entered then. In the same locality the manufacture of motors had been started, not long before. "Jim," said the manager of this concern, coming into the superintendent's office that fall, "Why didn't we get a show on this motor order. We can give you just as good a machine and we can do it at a good deal less cost, because we aren't wasting our money on advertising and high-priced salesmen like the company you bought from?"

"Well, to tell the truth, I hadn't thought of you," was the reply. "Perhaps it would be just as well if you did advertise a little; but I guess you're right. We'll be putting in some more motors before long, and I'll see what you can do for us."

That evening he mentioned the conversation to his son.

"I don't know, dad," said the boy, "whether it's a good thing to buy from him or not. He isn't very well established, and if he goes out of business you may have trouble in getting repairs for the motors when they need them. The fact that he saves money by not advertising and by not employing expert salesmen isn't anything in his favor. I'd rather bank on the man who is building up a good reputation, which he will have to protect, than on the fellow who makes capital out of skimping."

The new man, however, carried the day. The next order for motors was divided with him, and later he sold more. Their service was fairly satisfactory for some time; but today both he and the machines are out of business. The young engineer was a good prophet.

Continuous advertising of any product is a guarantee of its quality.

To buy advertised products is to be assured continuous satisfaction.

Molding Methods in an Art Foundry

By E. A. Suverkrop *

Detailed description of the art of molding bronze medallions. The practice of the two foremost art foundries in the world. Preparation of the pattern, the tools, mixtures of metal used, sand, partings, facings, etc.

*Associate editor.

I think that I am safe in saying that heretofore no accurate account (if any at all) of the molding methods and materials used by art casters, has ever been published.

The following article will cover the methods used by the two foremost casters of art objects in the world: The August Griffoul Brothers Company, Newark, N. J., and Liard, of Paris, France. However, Liard makes small bas-reliefs only, while Griffoul molds statuary by the false core method, and also produces the finest of commercial work in bronze, gold and silver.

I am indebted to the senior member of the concern in Newark for the photographs and detailed description. While working for Mosman, of Chicopee, Mass., he molded and cast several of the doors for the Capitol at Washington, and those for the State Capitol of Indiana; he has also molded work for Rodin, the French sculptor, whose autograph letter, stating his appreciation of Mr. Griffoul's work, I have seen, and James E. Fraser, the New York sculptor, tells me that no other caster in this country or France can duplicate the firm's small relief work.

FIG. 1. BAS-RELIEF BY JAMES E. FRASER, MOLDED BY GRIFFOUL

These facts are mentioned to show the high source and consequent value of the information I am transmitting.

FRENCH SAND USED EXCLUSIVELY

For the molding of work shown in the various illustrations, French sand is used exclusively, but the raw sand is never used alone, being always tempered by the admixture of burnt sand in varying proportions to suit the differing requirements of the various parts of the work.

Fig. 1 shows a finished medallion molded and cast by Griffoul from a plaster cast of the original, which was modelled by James E. Fraser.

THE TOOLS USED

Fig. 2 shows some of the tools. Those shown cover practically all the classes of tools used. *A* and *C* are rammers made of lead for hard ramming, which will be referred to later. *B* and *L* are also rammers, but are made of wood for light ramming. *D*, *E* and *F* are wooden mallets; they are also used for ramming, but their use covers the compressing of the surface only of the sand in the flask. *M* is also of wood and for ramming; its flat surface is used to "spank" the sand in the flask.

G, *H*, *I* and *J* are spatulas or "slickers," as I have termed them. They are made of brass and steel and range from the diameter of a toothpick to almost any width, according to the work they are to be used on. The small steel ones are made in France, but the molder shapes them or has them shaped to suit his individual fancy.

The tool *K* is used for cutting the gates, risers, etc. This tool is made by bending a piece of flat spring steel (about the size of an alarm-clock main spring) and binding it to a wooden handle as shown.

N is a piece of saw steel about 3/64 inch thick, 2 inches wide, and about 18 inches long. It is used to scrape off the surplus sand from the faces or backs of the flasks.

A rigid triangular bar scraper with sharp edges is sometimes used for the same purpose, but this is not so efficient a tool as the flexible one.

Fig. 3 shows a medallion of the poet Longfellow, which was modeled by John Flanagan, just as it came from the sand. In thickness it is about ⅛ inch. Note the wide gate.

PREPARATION OF THE PLASTER AND SAND PATTERN

For molding this medallion the procedure is as follows: A flask is filled with burnt French sand. This is rammed hard and stripped off level with the flexible scraper shown at *N*, Fig. 2. The pattern in this case is plaster of paris, see Fig. 4 at *D*, about ¾ inch thick and measures about 6x8 inches. Around the sides of the plaster pattern and about ¼ inch from the face, a "parting line," indicating the desired thickness of the casting at the edges, has been scratched by the sculptor. The pattern is laid, face up, on the flat surface of the sand in the

flask, and its outline is scribed thereon. The pattern is then laid aside and the sand within the scribed line is dug out to a depth of about ½ inch, to bring the scribed parting line level with the sand in the mold.

The pattern is carefully bedded in the depression so that its face is about ¼ inch above the face of the surrounding sand. Care is taken to back up the plaster pattern all over its rear surface to prevent its being broken by subsequent rammings of the copes (note the plural), which are made with the plaster pattern.

The edge of the sand where it touches the plaster pattern is carefully filled in with new sand, hammered down with the mallet *F*, Fig. 2, and leveled off. While this filling-in is being done, the pattern is held down against its bed of sand and prevented from rising by a weight, such as an ingot of copper on its face, a soft bag of facing being placed between it and the ingot.

Cutting the Pouren and Risers

The tool shown at *K*, Fig. 2, made of a piece of thin spring steel, is now taken, and the pouren, as shown at *A*, Fig. 4, is cut into the face of the sand; the risers *B*, Fig. 2, are also cut with this tool. The risers are made zigzag as shown, to trap at *C* any dirt that might fall in and spoil the mold.

Sand Dowels Used for Exact Locating

While the flasks are provided with metal pins to locate them one on the other, their use in work of this high class is only to obtain approximate location of the flasks with relation to each other. The dowels and dowel holes which actually locate the cope and drag are of *sand* (if a hole can be said to be of sand), and are made in the following manner: The molder takes a sharp trowel-shaped slicker, shown at *G* or *H*, Fig. 2, and cuts the boat-shaped depressions in the face of the sand at the positions *E*, Fig. 4. After removing the sand from the depressions they are smoothed up with the same slicker and the whole face of the sand and plaster pattern is dusted with potato starch, which is then carefully brushed off the plaster pattern with a camel's hair brush. It is again dusted with starch which is blown off this time with the bellows. Powdered soapstone or talcum is now dusted on very lightly. No starch must be left on the plaster pattern, as it would be transferred therefrom to the sand impression, and would cause scabs on the bronze casting, but as a parting for the rest of the mold it is satisfactory. For this reason great care is exercised to keep it away from the plaster. This finishes what is in reality the complete pattern, a pattern composed of part plaster and part sand. It is left lying face up while the cope mold for the face of the medallion is made from it in the following manner:

Making the Cope or Front-mold Part

A pinch of French sand is placed at each of the four corners of the flask containing the pattern. A flask is taken and brushed all around the inside with boiled potato starch, to hold the sand. This flask is then placed on the pattern flask, Fig. 4, and pressed down till the pinches of sand at the corners are squeezed and separate the faces of the two flasks about 3/16 inch. The object of this is that the sand in the mold parts (cope and drag) will meet and touch instead of having the iron flasks themselves touch each other.

With the cope or front flask in place, French sand in the proportion of one part burnt to two parts new is carefully sifted through a fine sieve, and then a second time sifted to a depth of, say, ¼ inch over the face of the plaster part of the pattern. The flask is then partly filled with a mixture of two parts burnt to one of new sand and finally filled with all burnt sand. The cope is then rammed fairly hard; that is to say, much harder than is usual in the ordinary brass foundry where ordinary sand is used. After ramming, the back of the cope mold is scraped off level with the flexible scraper. The cope, Fig. 5, is then carefully lifted off and laid to one side. I have reversed the reference letters on the cut for clearness.

The molder next brushes, with a fine camel's hair brush, some fine plumbago over the face of the plaster part of the pattern, Fig. 4. The plumbago is in the form of an impalpable powder and does not add any appreciable thickness to the face of the pattern, it appearing as though

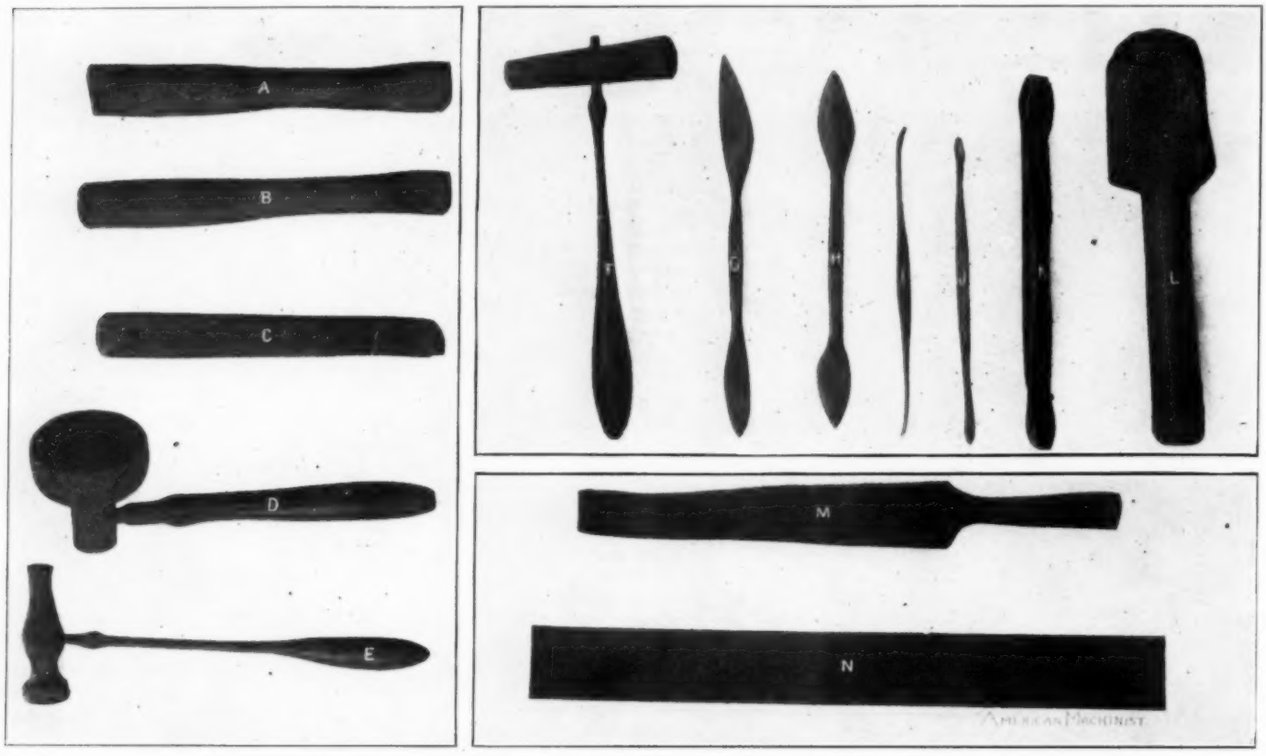


Fig. 2. Some of the Tools

FIG. 3. THE CASTING AS IT CAME FROM THE MOLD

it had been merely rubbed with a very soft lead pencil.

FACING WITH FRENCH CLAY

The cope, Fig. 5, is then dampened on the face. This, on small work, is done with water sprayed from the mouth in the same way that the Chinaman dampens clothes for ironing. For larger work an atomizer is used, the lungs of the molder supplying the blast. The damp face of the cope is then thickly dusted with finely ground French clay from a muslin bag. This coating of clay dust is possibly 1/32 inch thick. On top of the clay a very thin parting of talcum powder is then dusted from a bag. The cope, Fig. 5, is then replaced on the pattern, Fig. 4. The back of the cope, Fig. 5, is roughed up with a slicker *G*, Fig. 2, used like a knife and is again rammed up hard, burnt sand being added to the back as required. This ramming is done with the wooden mallet shown at *D* or *E*, Fig. 2. After ramming to the molder's satisfaction, the back is again scraped off level and the cope lifted. In drawing the cope from the pattern there is no "rapping" of any sort. For this reason, excepting the shrinkage of the metal, the casting is exactly like the pattern.

SKILL REQUIRED IN DAMPENING THE MOLD

If the cope has been properly dampened it comes away from the pattern perfectly, but if too wet the moisture goes through the coating of clay and talcum and these are apt to stick to the face of the pattern. If not damp enough, the clay, while it does not adhere to the pattern, refuses to stick to the sand in the cope. For these reasons the cope must be dampened to a certain degree, no more, no less, and the ability to gage this comes with practice only.

RESTICKING PARTS BROKEN OFF

Occasionally with a practically perfect mold, small pieces will break away around the edges, due to the plaster pattern being undercut. The molder dampens the face of the cope with boiled starch where these pieces have broken away, using a trowel-shaped slicker, he lifts the broken fragments and places them where they belong, the starch holding them while he smooths the joint. The French clay leaves a very smooth surface, but examination under the microscope will disclose microscopic vents be-

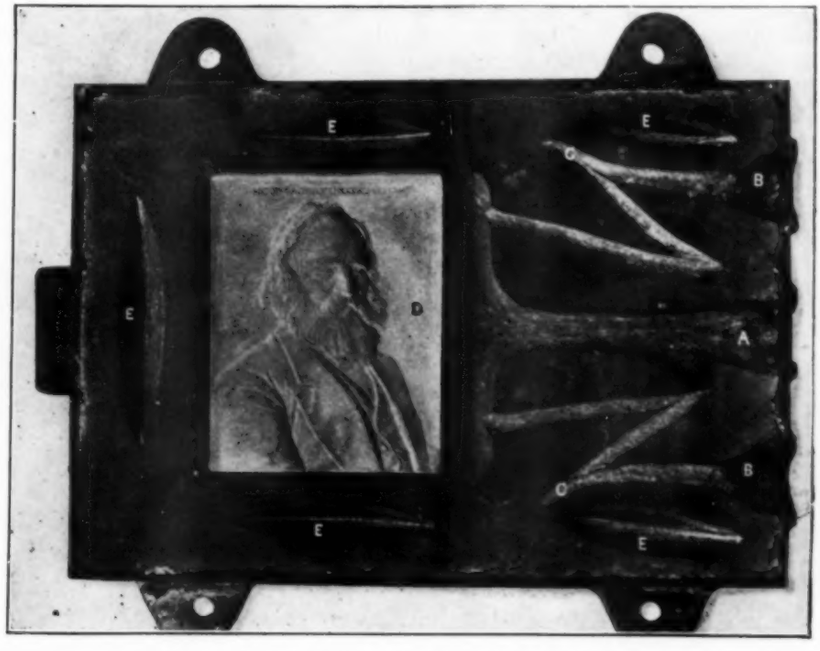


FIG. 4. THE PLASTER AND SAND MOLD OR PATTERN

tween the minute grains for the escape of the gases.

The flask with the plaster pattern is now put to one side, and the cope, Fig. 5, is laid face up. Where the gate *A* was cut in the pattern flask a half-round ridge of sand appears in the cope. The risers *B* also have similar ridges and male "dowels" of sand appear at *E*, Fig. 5, which fit the dowel depressions at *E*, Fig. 4.

The tool shown at *K*, Fig. 2, is again taken, and these gate and riser ridges are cut away and transformed into grooves. The male "dowels" are left as they are, except that they have the sharp edge, showing dark in the cut, removed from the top so they will touch on the sides only; otherwise they are untouched.

The rectangular entrance *F*, Fig. 5, from the pouren to the medallion, is now cut away by the molder, who uses the trowel-shaped slicker for the job. The pouring hole is coated with plumbago and the cope is laid aside, as shown in Fig. 5, practically finished.

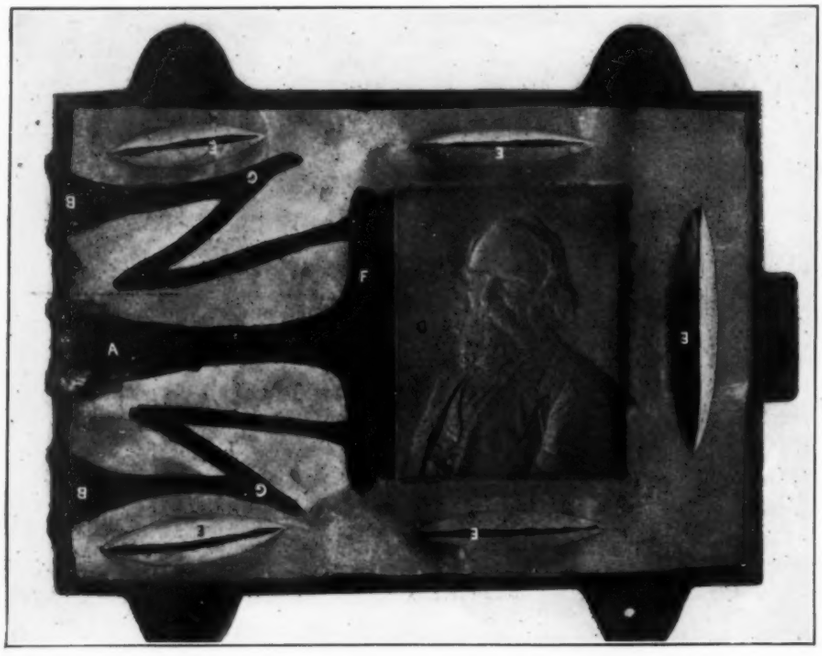


FIG. 5. THE COPE OR FRONT MOLD PART

MAKING THE SAND PATTERN FOR THE BACK

The pattern flask, Fig. 4, is again placed face up and another flask is coated inside with starch, ready for the reception of the sand. It is then placed on the pattern flask, filled with sand in the same way that Fig. 5 was, and rammed very hard with the lead rammer *A*, Fig. 2. This *cope* is not used in the final casting, but now becomes a *pattern* from which the back or drag of the final mold is made. That is the reason it is rammed so hard—to make it durable. If care is exercised, several backs can be rammed up from it, the fronts being rammed up from Fig. 4.

This cope, which is exactly like Fig. 5, except that it is rammed hard, is scraped off flat at the back and a flat iron plate is laid on it. It is then drawn from the original pattern and the pattern flask is again laid aside. The hard-rammed cope with the iron plate still on it is laid face up on the bench and dusted with talcum powder preparatory to making the drag or back of the final mold. The four pinches of sand are placed on the corners of the flask, as previously described.

MAKING THE BACK MOLD PART

For this drag or final mold back, a flask is starched and laid in place. A mixture of two parts burnt to one part of new sand is twice sifted in a fine sieve and put on the face of the medallion, as previously described. This is rammed to about the same hardness as the first described cope, Fig. 5. When drawing this last flask some pieces of sand around the outline broke away and adhered to the drag. The molder pasted the broken cope with boiled starch, replaced the cope on the drag, and on removal again the broken particles were stuck in place. The mold is then dampened, dusted with French clay and topped off with talcum, again placed in position on the hard-rammed "sand pattern" and rammed up, all as previously described for Fig. 5. After removal, the pouren and risers are touched up, the mold dressed up all over and the sharp bottoms of the female sand dowels are cut out, as shown at *E*, Fig. 6, so that the male sand dowels will seat properly. The molder now takes the hard-rammed sand pattern and puts it to one side.

SHAVING THE BACK MOLD PART

The thickness of the medallion is now made on the drag or back mold, Fig. 6, by the molder who cuts the sand away free-hand, using sharp trowel-shaped slickers for the job. The appearance of the back or drag of the sand thus cut away is shown at *G*, Fig. 6.

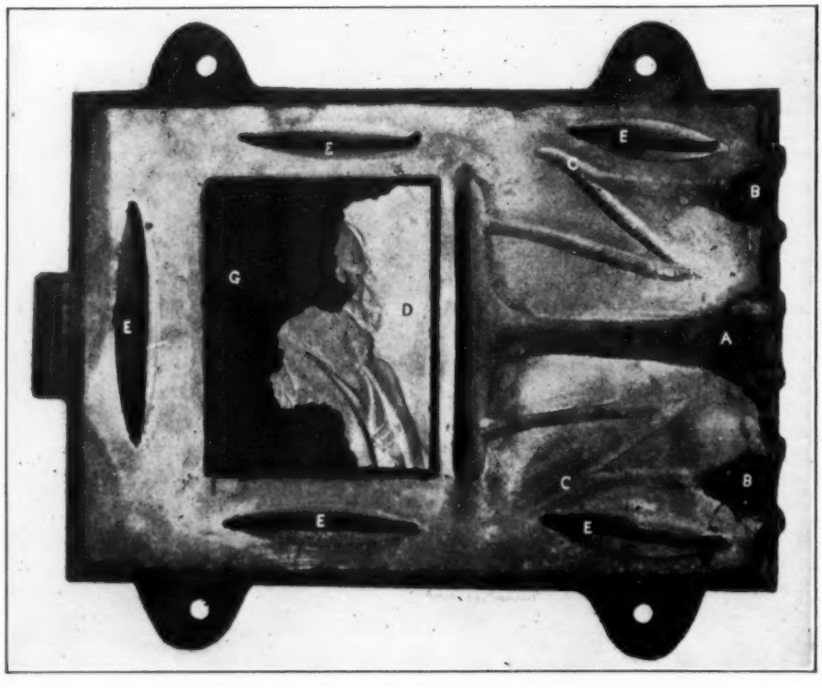


FIG. 6. THE DRAG OR BACK MOLD PARTLY SHAVED

After the back is cut away all over the medallion, it is dusted with talcum and the front of the mold placed on it. The white talcum powder shows where the cope bears on the drag and whether it closes properly. The back of the medallion is painted with black lead and water. The front of the mold is also painted with black lead, *but not on the face of the medallion*. The cope and drag are now baked in an oven at about 200 degrees, the length of time varying from over night to several days, according to the size of the mold.

Closing the Mold

When the mold is ready to close, the wooden cross bars *A*, Fig. 7, with a wooden screw *B* in each end, are laid on the floot. An iron plate *C*, Fig. 7, is then laid on them and on top of this iron plate about an inch of sifted sand to act as a cushion. On this the drag *D* is laid, then the cope *E* on the drag, then another cushion layer sand covered by another iron plate, and finally the cross bars *F*. The wooden hand nuts *G* are now screwed down and the mold tipped up at a convenient angle for pouring.

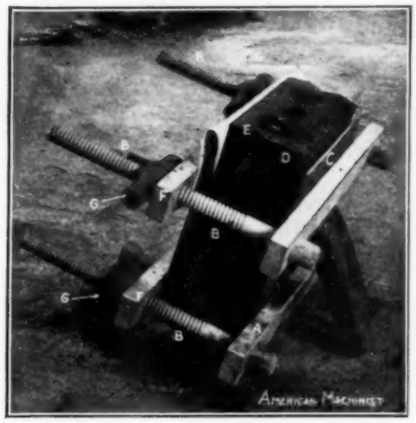


Fig. 7. The Mold Ready to Pour

The bronze is poured very hot and very quickly, but, of course, skill is here again required, for if the metal be too hot, pin holes will appear on the surface, and if too cold it will not run. The mixture used for medallions is 100 parts copper to eight parts tin. On small work, such as shown, the castings can be knocked out almost immediately.

Why Bronze Medallions Are Costly

Molding medallions requires skill of the highest degree. A fault on a statue can be readily plugged, but on a medallion this is impossible, and the smallest defect stands out like a proverbial "sore thumb." The comparatively high cost of this class of work is attributable to several causes: The men who can make the molds can probably be counted on the fingers of one hand, and even these experts sometimes lose five out of six molds through the minute defects referred to. Beside all this is the price the sculptor gets for his part of the work.

Manufacturing on the Engine Lathe in a Big Shop

By John R. Godfrey

As I have ventured to remark on one or two previous occasions, the proper selection of machines for any job is what marks the superintendent as a howling success, while guessing wrong puts him in the scrap heap in a hurry. And the worst of it is that there is not a system of management, scientific or otherwise, that I know of, that brings the same answer in two different places.

For a long time the engine lathe has been hitting the tobogan, as the Boweryites have it, when it comes to general manufacturing, and many have taken it as a sign of paresis if a superintendent gave an order for an engine lathe except for repair work.

And, worse than that, the salesman of the turret would seek the high mogul in the inner shrine, tell of the awful blunder his superintendent was making, and quietly tap his forehead with a knowing look. The super was surely a fit subject for the brainstorm artist. This is the worst kind of thing to combat, because the grand mogul only sees progress with a capital P when it is hitched on to a new machine and not when it has to do with using an old one in a different way.

Not that there is not a tremendous field for both the automatic and the turret, but we must not forget that there is also a place for most other good tools—and the engine lathe is one.

This all leads up to the work one of my good friends is doing in a big shop, making the highest-grade material, in good-sized quantities. He has been making some extensive experiments with the engine lathe and drop forgings as against the turret and bar stock—and he has some mighty interesting results.

On some plain work, with an inch stem sticking out of a 3-inch flange, he gets the forging for less than the bar-stock cost, and he beats the turret with a single-point tool in the engine lathe, using a plain, rigid lathe, without a lead screw. And he does not use solid stops altogether either, but the graduations or observation stops, as Bullard calls them, on his cross-feed screw. His shoulders be gets by stops of the usual kind.

On alloy-steel forgings, where the stock costs a wad of money, he reports much less wastage than with the other method. That he attributes to the errors in setting up tools and trying the pieces.

Saves in Grinding

Then, too, he finds another saving. These pieces have to be ground, and as they already have centers, they go into the grinder at once and run much nearer true than when machined without centers. This means that the grinding allowance can be less, and that time is saved in grinding, as well as in waste from pieces not quite truing up.

On other pieces he has found that only the single point of the lathe tool gave just the flatness and finish he wanted.

Of course, it seemed like a step backward to some of his loving friends, but he has been able to cut his costs nearly 30 per cent. on some of the jobs, and he is just hard-headed enough to believe it is worth doing.

But just to show that he has not gone engine-lathe crazy, as all of us are apt to do when a machine works out well on one job, I must tell you what he is doing in other lines.

Some of his work is cover plates, which must fit oil-tight and be true and flat. Turning or facing in the lathe took considerable time; milling did not give what he wanted on this job, though it does in many cases; so he took it away from both lathe and miller and put it on a vertical-end grinder. Now the rough casting goes right to this machine and comes off finished. Good job at low cost.

All this means a lot of careful study, the balancing of the cost of forgings against other stock, the first cost, and maintenance of machines, labor cost, production per square foot, and other things. And the man who dares go back to the simple life in the face of all criticism and can make good, is a man worth knowing and watching.

Organization by Machines

Among other things which this same friend has found best in his work is the organization of departments by machine equipment, locating these near each other with reference to the steady flow of the product through the plant. By a careful study of the plant and the moving of some 400 odd machines, he has worked this out very carefully so as to group similar machines and at the same time save rehandling of the work, as is too often the case with this arrangement.

This, coupled with a speeding up of the line shaft from 175 to 250, gives a better distribution of power than was possible with the old arrangement.

But, as another example that he has no inflexible rule which must fit all conditions, I found that he had put two scleroscopes in the hardening room instead of keeping them in the inspection room as formerly. This allows him to test the hardness of the work before it has been handled, and saves transportation to and from the inspection room.

Here, to my mind, is another evidence that he is a big man. For, as quite a noted engineer of his day told me, more years ago than I like to remember, "good engineering is making the best use of the material at hand under the conditions you must work with."

And the man who does that comes pretty near being a good engineer to my way of thinking.

Machining Headstocks of Lathes

Western Correspondence

Simple types of jigs and fixtures used for milling cap seats of lathe heads, finishing bottom surfaces, boring spindle boxes, etc., complete sets of boring bars fitted with double-end cutters for boring, facing and undercutting ends of bearings.

A babbitting fixture, some useful tools for turning eccentric ends of back-gear shafts and a drill jig for cone pulleys and face gears.

The first operation in the machining of the heads of the lathes built by the R. K. LeBlond Machine Tool Company, Cincinnati, O., is the milling of the seats for the caps, and this is accomplished in the fixture illustrated by Fig. 1. In this engraving the lathe head is shown in one view only, namely, the end elevation, but the fixture is of such design as to indicate at once the method of mounting and locating the work preparatory to commencing milling operations.

How the Casting Is Held

The rough headstock as it comes to this fixture is located upon the two sliding cones *A A*, which enter the cored holes for the back gear-shaft bearings, and with the casting suspended in this manner the supporting screws in the base of the fixture are adjusted to bring the head up to an approximately level position, after which the clamps are tightened to secure the work. The rear part of the head is held securely by the cones *A A*, which are adjusted into the cored openings by the tightening of the nut at the end of the rod upon which the cones are mounted.

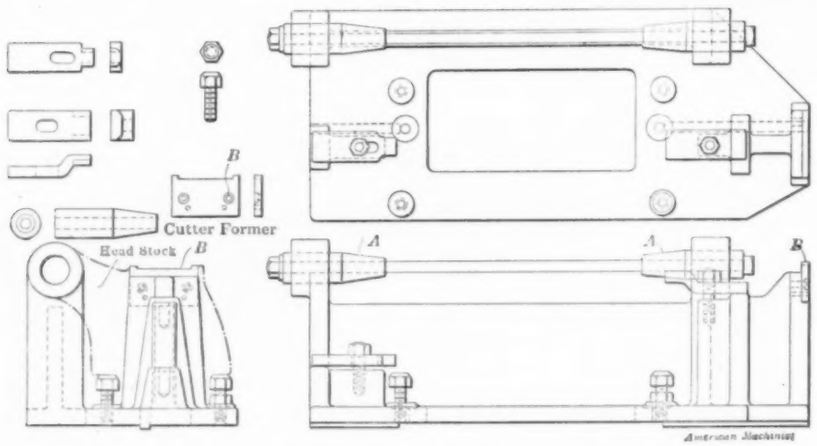


Fig. 1. Fixture for Milling Cap Seats in Lathe Heads

A gang of inserted tooth cutters is passed across the top of the headstock casting, facing the seat for the cap and milling the recess which receive the finished edges of the cap. The gage for setting the cutters quickly to the desired position is located at *B* at the end of the fixture.

Milling the Bottoms of the Headstocks

The second operation consists in turning the headstock over and locating it bottom side up in the fixture, Fig. 2, where the V- and flat bearing surfaces are milled along the bottom. Here the casting is located by the cap seats just milled, which fit over the finished guides on the base of the fixture, as noted upon the drawing. A pair of clamps are then tightened and a gang of cutters which are adjusted to the setting gage at the end of the fixture, are brought into service for milling the flat surface and the V bearing.

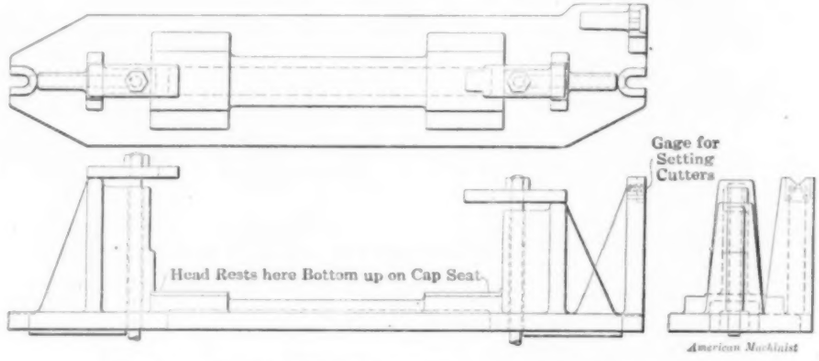


Fig. 2. Fixture for Milling Bottom of Lathe Heads

A Fixture for Headstock Caps

The fixture in Fig. 3 is for holding head caps while the faces and edges are undergoing milling operations. This fixture holds two caps which are pressed against stop plugs in the middle rib of the fixture, by setscrews passing through tapped bushings in the outer walls. These bushings are readily renewed in case they become worn out. The caps rest on seats in the fixture and are pressed against a stop surface at the rear by thumb screws in front.

The cutter gang is also shown in this view and it will be noticed that the mills are spaced by an adjustable collar which enables the cutters for the sides of the cap to be held to the exact width required. The detail of the spacing collar shows the construction clearly.

Provision for Drilling and Boring the Heads

In general, the methods of machining the LeBlond regular lathes and their "Heavy Duty" tools are similar. The boring fixture and tools in Figs. 4 and 5 are for the 25-inch "heavy duty" lathe but practically the same type of fixture is used for similar operations on other lines of lathes built by this company. The boring process illustrated, follows the drilling and bolting of the caps in place, and the drilling of the underside of the head to receive the holding down screws. The latter operation is accomplished with a flat jig that is adapted on one side to fit the bottom of the head and on the other side to fit on the ways of the lathe bed, so that the same jig drills both head and bed for the holding down members.

This jig locates endwise against corresponding surfaces on the ends of the head and bed so that when the lathe is erected, the gear train will aline properly.

The Boring Fixture

The method of boring for the spindle and back-gear shaft bearings is well illustrated by Figs. 4 and 5, and the latter

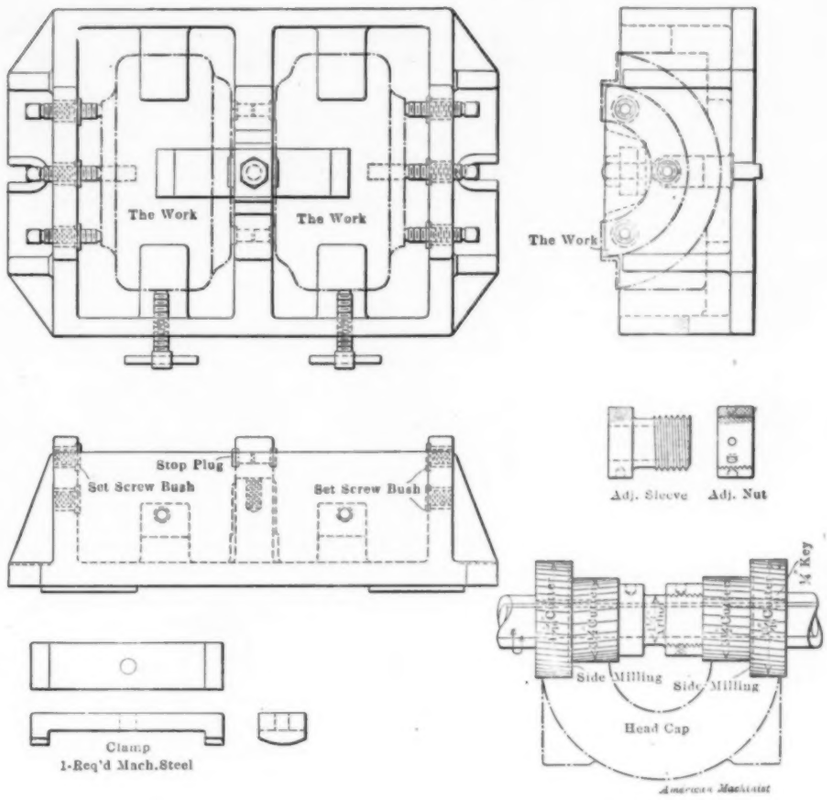


FIG. 3. MILLING FIXTURE FOR HEADSTOCK CAPS

engraving brings out the details of the fixture and the double-end cutting tools. The device is used on a horizontal miller and is provided with one V and one flat bearing surface to receive the head after it has been scraped to a true surface on the bottom. The head is held down on tissue papers by bolts in the regular holes under the corners.

The cutter bars are fitted in cast-iron bushings which revolve with the bar and which run in other bushings driven into seats bored in the fixture. The rotating bushings are threaded at one end to receive a collar which with the flange at the other end retains the bushing in place.

The cutter bars are driven by a floating connection from the spindle and the accurate qualities of the fixture itself are reproduced in the boring of the lathe head. In case wear occurs in the bushings which control the bars, these bushings may be readily replaced.

ARRANGEMENT OF CUTTERS

It will be seen from the details in Fig. 5 that there are two bars for boring the spindle box seats and one bar for the back-gear shaft bearings. Of the former two bars one is for roughing and facing; the other for finishing. The rear bearing for the spindle is babbitted, and the front bearing of cast iron. Before pouring the metal in the rear bearing the opening is machined with the roughing bar and two dovetail facing cutters are used for producing the necessary undercut for the metal at the ends of the bearing. These two dovetail cutters are seen in place in the roughing bar in Fig. 5.

After the babbitting of the rear box has been attended to the finishing bar is brought into service and the boring operation completed.

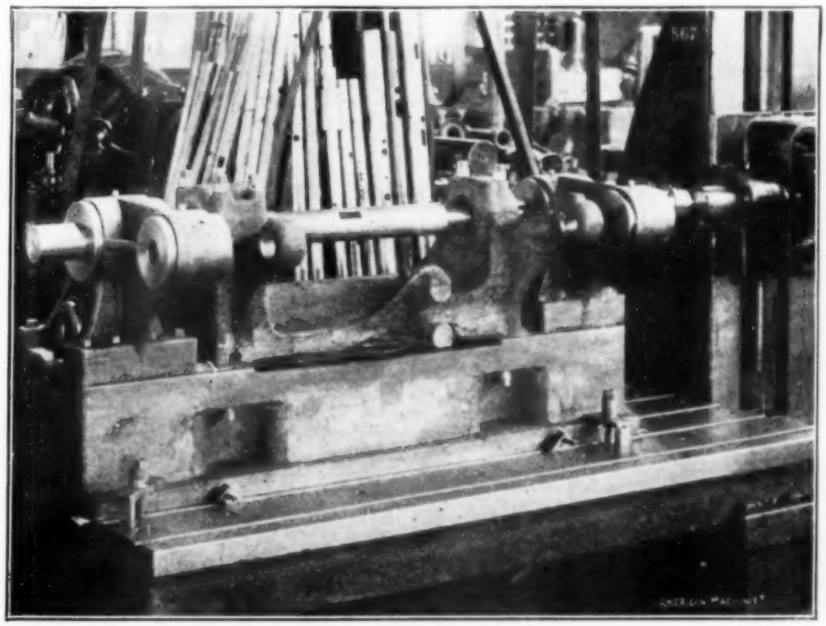


FIG. 4. FIXTURE FOR BORING LATHE HEADSTOCKS

A BABBITTING DEVICE

The device in Fig. 6 is used in connection with the work of babbitting the boxes. It consists of a half arbor *A*, carrying at the ends flanges *B* which are set up against the sides of the casting to be babbitted. There is a plate *C* attached to the flat surface of the arbor and on this plate is pivoted the funnel *D* through which the metal is poured. A rod in hole *E* in the side of the funnel casting is used to swing the funnel about its pivot after the pouring process, this movement shearing off the metal after it solidifies.

The half arbors are made in various sizes to suit the size of box to be poured and in each instance there are two plates *C*, one of which is used when the box is being poured, while the other is attached to an arbor for pouring the caps. In one case the plate fits into the cap seat in the lathe head; in the other, the plate has shoulders along each edge and fits over the edges of the cap. Both head plate and cap plate are shown in the drawing.

TURNING ECCENTRIC ENDS ON BACK GEAR SHAFTS

Back-gear shafts are turned on the ends to the required degree of eccentricity by means of the appliance shown in Fig. 7. This is a cast-iron sleeve bored off center the required distance and relieved internally by coring, for the greater portion of its length so that the shaft to be turned, when slipped into the sleeve, takes a bearing for a few inches only, at each end. A hardened-steel plate is attached to each end of the sleeve and this permits the lathe tool to be run up to the plate and the latter to be

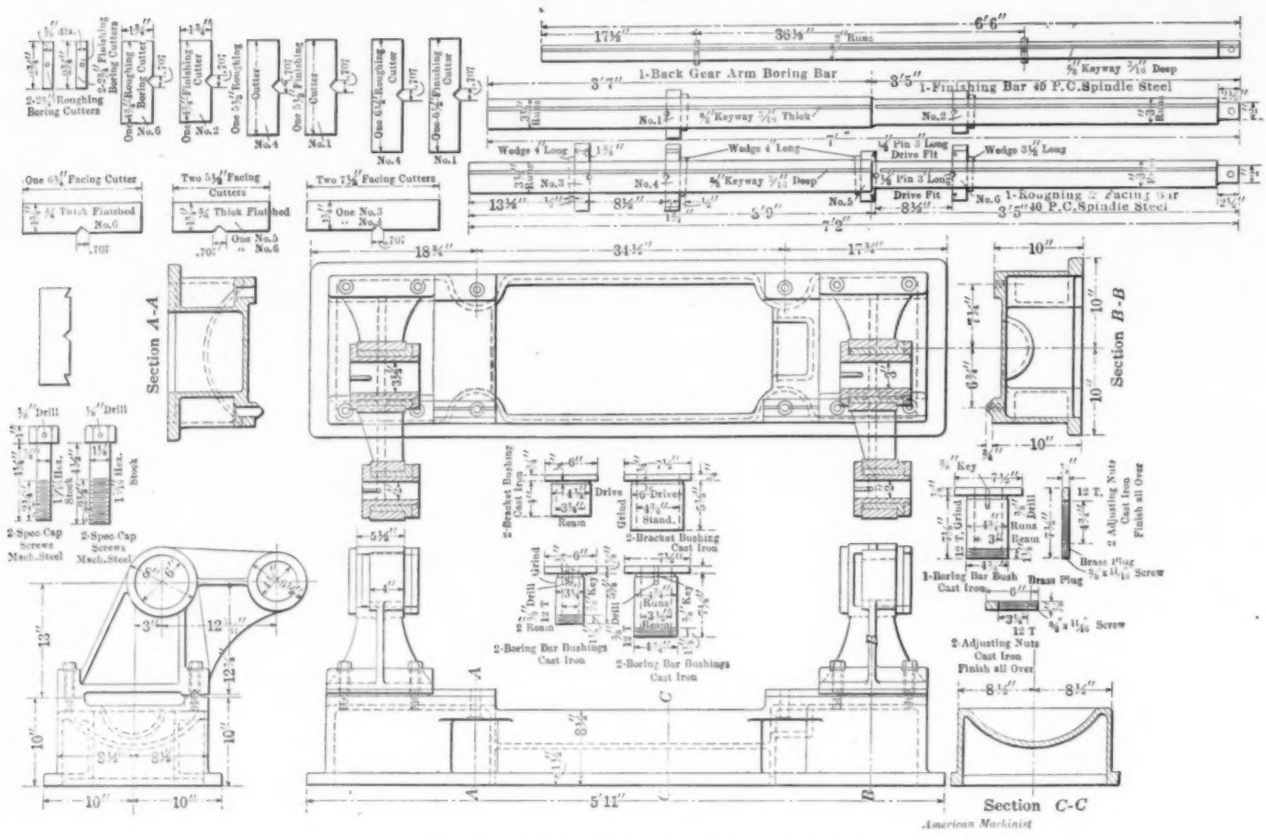

1-Back Gear Arm Boring Bar
1-Finishing Bar 40 P.C.Spindle Steel
1-Roughing & Facing Bar 40 P.C.Spindle Steel
Section A-A
Section B-B
Section C-C
2-Bracket Bushing Cast Iron
2-Bracket Bushing Cast Iron
2-Boring Bar Bushings Cast Iron
2-Boring Bar Bushings Cast Iron
1-Boring Bar Bush Cast Iron
2-Adjusting Nuts Cast Iron Finish all Over
American Machinist

FIG. 5. BORING FIXTURE FOR LATHE HEADS

used as a gage in cutting the eccentric ends to a shoulder of the length desired.

The drawing also shows the special chuck which is threaded to screw onto the nose of the lathe spindle and which carries the inner end of the cast-iron sleeve for holding the work. The outer end of the eccentric sleeve is, of course, mounted in the steady rest.

The work is gripped in the sleeve by two setscrews that act upon brass shoes as indicated in the drawing. After one end of the back-gear shaft has been turned the whole device is reversed in the chuck to bring the other end of the work into position for machining.

Another detail shown by this drawing is the special steady-rest bushing which forms a suitable bearing for the outer end of the turning sleeve and prevents wear on the sleeve due to direct contact of the steady-rest jaws. The bush is split at one side and adjustment is readily made to maintain a proper bearing between sleeve and bush.

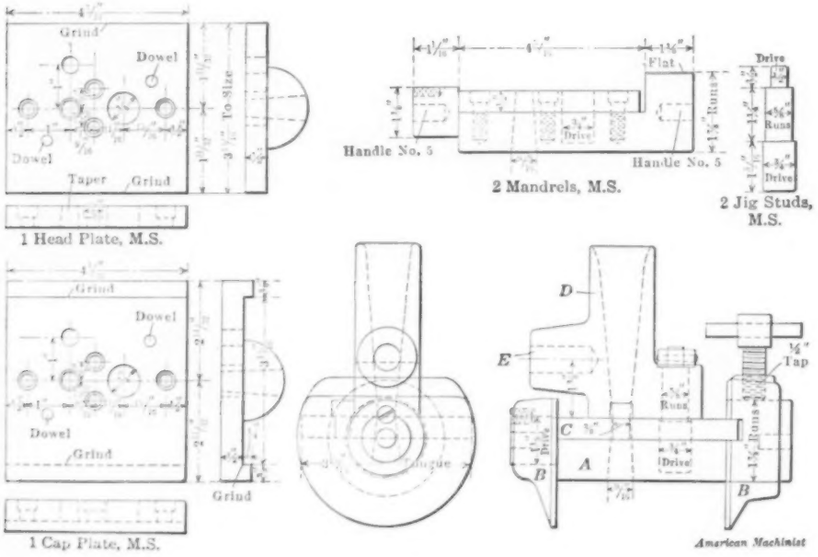


FIG. 6. BABBITTING JIG

CONE PULLEY DRILL JIG

Fig. 8 illustrates a jig for drilling the three holes in the face of the spindle-driving pulley for the spring plunger which locks the pulley and face gear together. The same jig is also employed for drilling the seat in the gear to receive the plunger.

The jig is mounted on the cone pulley

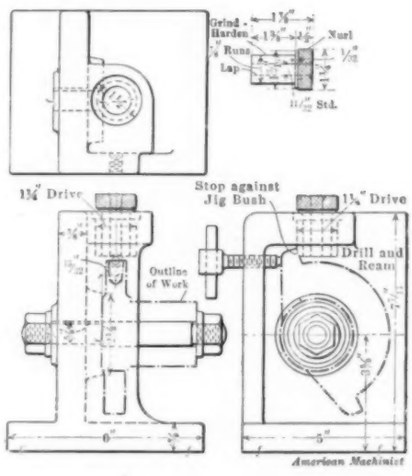


FIG. 9. JIG FOR DRILLING TAPER HOLE IN BACK-GEAR SHAFT BUSHING

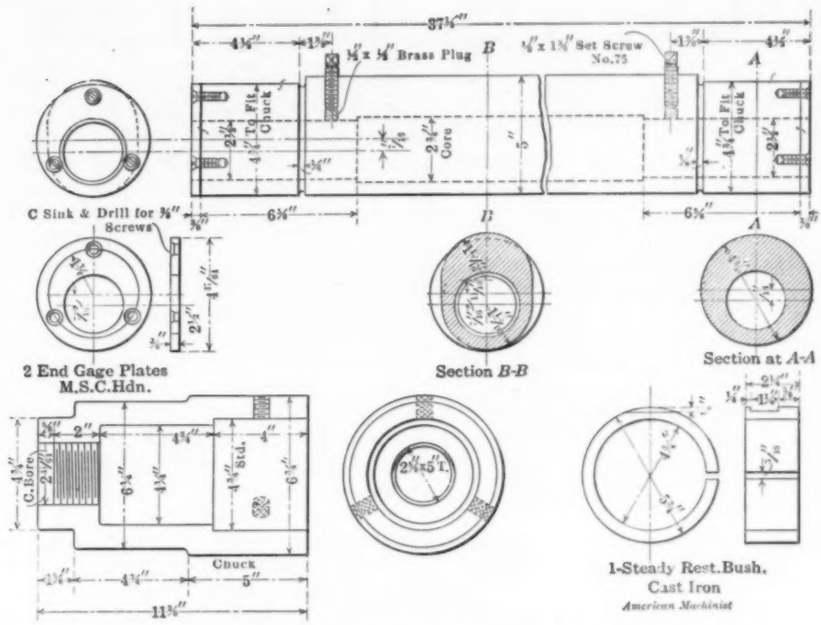


FIG. 7. ECCENTRIC SLEEVE AND CHUCK FOR TURNING BACK-GEAR SHAFTS

by slipping the split hub into the pulley bore, after which the taper plug is drawn up by its nut to expand the split hub and hold the jig securely to the pulley. The latter rests vertically during the operation, on a three-post fixture which supports the pulley by its flange, while the three ⅞-inch holes in its face are drilled and reamed with tools guided in the bushings shown in the drawing. The drill and reamer bushings are slipped into liner bushings fixed in the jig as indicated.

The plunger chamber in the face gear has two diameters, namely ⅞ and ⅝ inch, and the body of the plunger is reduced to ⅝ inch so that a spring chamber is formed between the head of the plunger and the bottom of the ⅞ portion of the hole. This hole is drilled to within 1/64 of its two diameters by 55/64- and 39/64-inch drills and then a tandem reamer is run through another bush to finish the two sizes to correct diameter and aline the two portions of the hole. This reamer and the different bushes used in the jig are shown in the details on the jig drawing.

ANOTHER DRILL JIG

The jig in Fig. 9 is for drilling and reaming the taper hole in the back-gear shaft bushing for locking the back-gear operating handle when the gears are thrown in. The bush has two lugs as shown in the engraving and the taper hole has to be a certain distance from one of the lugs, so this lug is used as a locating point for the work when placed in the jig.

As shown in the drawing, the jig is fitted with a fixed bushing which is flatted off at an angle to serve as a stop for the work and in this way the hole is located at the exact distance required from the inner face of the lug. The drill bushing is ground to fit nicely in the permanent bush.

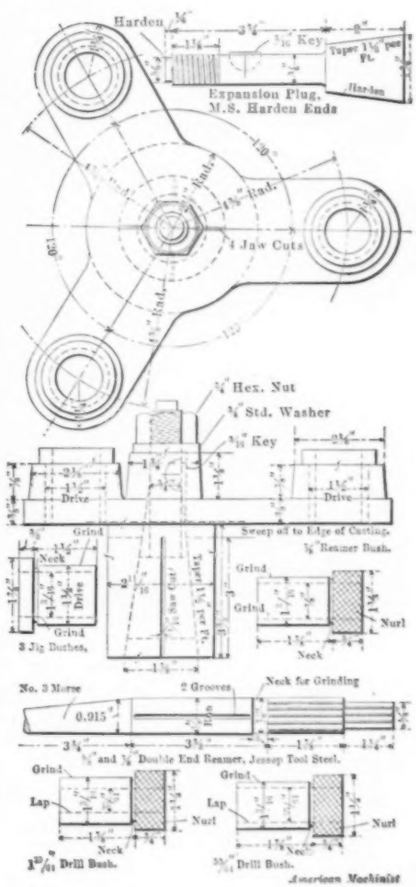


FIG. 8. JIG FOR DRILLING PLUNGER HOLE IN CONE PULLEY AND FACE GEAR

Hardening Expensive Tools

BY ROBERT GRIMSHAW

There are some old things of importance which should be thoroughly rubbed in. For instance, why should the machinist have so much fear when he undertakes the hardening of an expensive tool? Experience has taught me never to complete the cooling of a tool in water, but to withdraw it from the water just before the sizzling ceases and to immediately immerse it in oil. A can of water 12 inches in diameter and holding 8 or 10 gallons, and one of oil of the same size, will take care of a piece of steel 6 inches long and 3 inches in diameter. Such a piece can be fairly heated in 30 minutes. The heating should not be hurried, and the blast should be avoided, particularly when the steel is red. The piece should be quickly pushed down through the water and then moved about, until just before sizzling ceases—make no mistake about this—then plunged into oil or allowed to remain until cool; or, if it is removed from the oil while still warm, it should on no account be placed on a cold surface, unless such surface is a poor conductor of heat.

The New Catalog

In preparing the text for a new catalog which is to replace an old one or one which is out of print, it is desirable to lay the old one before all the foremen and some other employees, with the request to note whatever mistakes of omission or commission have been made therein; and to make suggestions for the improvement of the new one. Every department should have an opportunity to express its opinion concerning the old one and to make suggestions for the new. By this means, many unnecessary questions on the part of the buying public will be avoided; for, as far as possible, queries that are often repeated should be answered in advance in the catalog.

The same remarks apply to the illustrations which accompany the text.

Promotion of Trade

Promotion of commerce has been made the subject of a 15-page pamphlet just issued by the Bureau of Manufactures of the Department of Commerce and Labor. After a rather full description of the work of the Bureau of Manufactures, the pamphlet outlines briefly in short paragraphs, somewhat after the manner of the congressional directory, the duties and functions of various branches of the Government which are carrying on service related to the promotion and development of trade and manufacture. Over 30 bureaus and branches of the Government are listed from the various federal departments.

Shop Lighting Design*

By C. E. Clewell †

The efficiency movement has brought about an appreciation of the important effect of good light on production.

This article includes notes on the practical planning for successful shop lighting, setting forth certain points that should receive special attention in work of this kind.

It also includes illustrations of a number of actual cases and treats of the factors entering into the design of these.

†Lighting expert, Westinghouse Electric and Manufacturing Company, East Pittsburg, Penn.

A recent scientific textbook on factory administration contains the following statements: "It can safely be said that the loss in labor efficiency and consequent output per man will certainly be found to be enormously greater than the cost of proper heating and ventilating facilities," and "abundance of light is as important as abundance of pure air."

In the consideration of artificial light for shop purposes, it should be appreciated that the eye is perhaps the most valuable of the senses of the workman; that it is likely to fail before the general vigor or the sense of touch are affected by advancing age; and that as an aid and a protection for the eye so that it may retain its full strength, the best lighting facilities are not any too good. Obviously, therefore, in the lighting of shops it should be the object to use enough lamps of suitable size to furnish adequate light for all ordinary shop operations, and to reduce eye strain and fatigue to a minimum.

The New Appreciation of Light

The marked interest that has recently been taken in the illumination of machine shops has come about in part through the efficiency movement, in part through the remarkable advances in apparatus and the means for producing artificial light, and also through the growing appreciation of many simple principles that have been overlooked and neglected in the past. The very notable attention that has been devoted to scientific illumination of shops is a matter of very recent growth, and the public at large is only beginning to grasp the significance of the difference between old and new methods of lighting. Scientific research and the practical development of new appliances and methods for the installation and the use of new electric lamps have produced results previously quite impossible.

Some Reasons Why Lighting Design Is Necessary

In order to attain the object of furnishing adequate light for all ordinary shop operations, the lamps must be operated from circuits of constant voltage, and the light itself should possess the following features:

Intensity—The light should be of sufficient intensity, and should come in the proper direction for each employee.

Uniformity—The lamps should be spaced in such a manner and so equipped with reflectors as to furnish light that is uniform over the entire working surface; that is, all over the floor space or on benches where work is performed, or is likely to be performed.

Elimination of Drop Lamps—The light from lamps mounted overhead should be satisfactory enough to make the use of individual lamps unnecessary, except in special cases.

Glare—The size of lamps and their mounting hight should be such as to avoid glare; that is, the bright rays of light shining directly into the eye, which produces a blinding and fatiguing effect.

For meeting requirements of this kind the science of illuminating engineering has been developed. The scientific design of lighting installations includes among other things:

(a) The judicious selection of a type of lamp best suited to given conditions.

(b) The choice of suitable size and number of units.

(c) The determination of the best spacing and mounting of lamps.

(d) Adapting the reflectors to uniform illumination.

(e) Avoiding glare by utilizing girders or other architectural details in protecting the eye from bright rays of lamps.

(f) Switching the lamps economically.

These and other items call for the most careful study in drawing up lighting plans. The illuminating engineer is now looked to for meeting the foregoing requirements and, moreover, for furnishing adequate light of the highest efficiency that is consistent with excellence and satisfaction.

Why Broad Experience Is Necessary

On the one hand, the very notable growth of illuminating engineering has been promoted by the exact design of lamps, of reflectors and globes, and by the formulation and application of rules for installation based on *theoretical* considerations.

On the other hand, in illumination work the results depend on the direction and distribution of the light from the lamps; the reflection of light from walls and ceiling; the absorption of light by dark surfaces; voltage conditions; and

Fig. 1. Lamps Lowered to Provide More Light

The illustrations in this article were all reproduced from unretouched photographs taken at night by the light of the lamps themselves.—Editor.

*This is the fourth of a series of articles on shop lighting being written by Mr. Clewell for the American Machinist. There have already appeared in Volume 34: "Machine Shop Lighting," page 595; "Drafting Room Lighting Problems," page 686; and "Foundry Lighting Problems," page 1076. Other articles will appear soon.—Editor.

dust and dirt in the air. These items cover a wide and almost unlimited range of variable factors bearing on lighting systems, aside from the various uses for which the light may be needed. It is not difficult to realize that the calculation of illumination in a *practical* case must be based largely on constants that have resulted from other installations of a nature similar to the one under consideration.

However, there need be no conflict in lighting work between the application of theoretical considerations on the one hand and the judgment resulting from broad experience in practical installations on the other, since both of these factors used conjointly are invaluable in scientific design and in the practical installation of lighting systems. In this brief treatment of the subject it is believed, however, that some practical instances with the points in design which were altered either before or after the installation, will be of more general interest and help to the shop man and others engaged in shop-lighting work than an attempt at a complete analysis of the theoretical items involved.

FIG. 2. LIGHT SURFACES MAKE MOUNTING AT THE CEILING ADVANTAGEOUS

It should be stated, however, that the ability to install electric lamps at the present time without great difficulty and, in a large number of cases, by the following of well defined rules and suggestions is due largely to research and investigation during the past year or so by specialists in the development of highly efficient lamps and accessories, together with much information now available from the experience of those who have made a study of the subject. This is a great advantage to the practical man because he can avail himself of the experience and information resulting from much painstaking study covering several years.

SIMPLE RULES THAT CAN BE OBSERVED BY ALL

As before stated, artificial lighting is often considered commonplace and simple in principles. As a fact, the subject is a broad one, involving many variable and uncertain factors, which make an exact predetermination of results difficult. In addition to this item, the vast number of uses to which light is put makes desirable a study of each individual case. Almost anyone can lay out a system of illumination, and apparent satisfaction will result, but the fact should not be overlooked that the suitability of a given quality and intensity of light is a test of time; eye strain and even permanent injury may result from the use of a given kind of light which, through ignorance, may seem fairly satisfactory to the workman. It is in the avoidance of such difficulties, as well as in promoting economy of operation, that engineering advice is of importance.

Some simple rules, however, can be stated as a preventive of eye trouble and as an aid in securing favorable results in planning lighting systems. Among these simple or common-sense rules are the following:

1. Always use a shade or reflector with a lamp; that is, do not use a bare lamp, which produces a glare, near the level of the eye.

2. As a general plan, mount the lamps high and out of the ordinary range of vision.

3. Use lamps of sizes consistent with the ceiling hight; that is, if the ceiling is low, use small lamps, and, if high, use larger lamps.

4. Always use the proper shade or reflector holder for a given lamp when installing tungsten lamps.

5. Light thrown vertically downward is not the only important component of the light; the sides of machines and machine tools often require good light.

6. Too much light is often as harmful as too little. A suitable number of the proper-sized lamps should be used for providing a satisfactory intensity of the light.

7. Control few lamps on each switch, so that lamps not needed may be turned out.

8. Keep the lamps and reflectors clean, since large losses of light result from dust and dirt accumulations.

9. Provide a maintenance department if the shop is large enough to warrant it, so that all the items associated with the upkeep of the lighting system may be taken care of systematically.

THE LIMITS TO RULES IN LIGHTING DESIGN

In a field as broad as that of illumination, rules for planning lighting systems cannot cover the subject nor all the cases likely to occur; even those set forth in the foregoing are given mainly as an aid rather than as a definite guide. It will be found in practice that scarcely any two locations are alike in all particulars, and even those most experienced in the field of engineering find it necessary to give careful study to almost every case that is presented. For these reasons, rules should be limited to the installation of those cases where it is either impracticable or impossible to secure engineering advice, and, in the main, such advice is highly desirable for almost every case of shop lighting. The small outlay in exchange for an unbiased opinion regarding plans and specifications for the lighting of the shop will often be found to be more than offset by the greater satisfaction and economy attending an installation based on expert advice.

SOME ELEMENTS IN LIGHTING DESIGN

Within the limits of such an article as this, it is impossible to embody complete rules and methods for the design of any lighting system. The object will be to indicate some of the items that must be considered in laying out such work, and which may aid those who must depend on their own resources in this work connected with the shop, and at the same time to hint at those points which must be known and which can now be ascertained in connection with successful plans. Many of the electric-lamp manufacturing companies now furnish information of this kind free of charge when requested, thus insuring better and more economical lighting than in the past.

Among the most important items in the design of shop illumination are the following:

(a) The spacing and location of outlets.

(b) The total number of watts required.

(c) The type and size of lamps to be used.

(d) The type and size of reflector and holder, or globe.

(e) The hight at which to mount the lamps.

(f) The method of switching the lamps most economically.

In planning the lighting for any shop location, the six foregoing items must be determined. These items may be amplified slightly as following:

(a) *Spacing of Outlets*—Definite rules cannot be given on account of the variable nature of conditions. The details

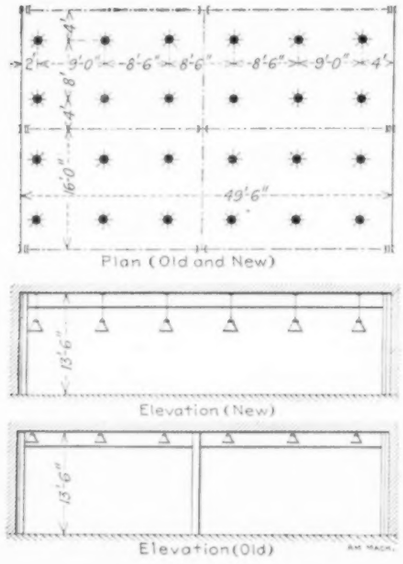


FIG. 3. THE OLD AND NEW ARRANGEMENT OF LAMPS FOR SHOP SHOWN IN FIG. 1

of building construction are often a determining factor in the location of outlets and should be studied. For example, if the shop is divided into bays, the outlets may be spaced to advantage in an arrangement symmetrical with the bays, this often being the best arrangement from the standpoint of wiring and switch control. Fig. 3 shows an arrangement of outlets symmetrical with the bay, 12 lamps being installed per bay. In general, however, the spacing of lamps should be governed by other spacing distances that have been found to be successful in similar locations. The distance between lamps depends to some extent on the hight of ceiling and on the matter of providing uniform and acceptable light over the entire surface to be lighted. Roughly, a spacing from 60 to 80 per cent. of the ceiling hight has been found to apply to successful shop lighting in a number of instances.

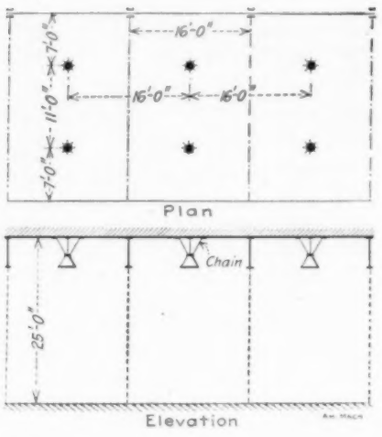


FIG. 5. THE ORIGINAL DESIGN USED IN THE SHOP SHOWN IN FIG. 4

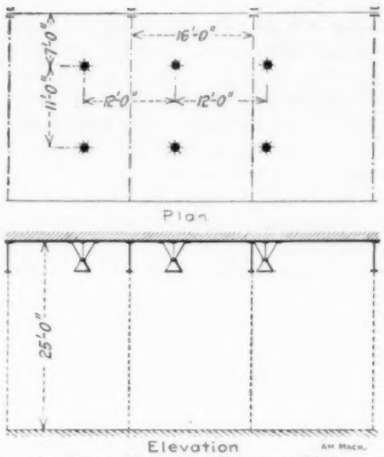


FIG. 6. THE MODIFIED DESIGN USED IN THE SHOP SHOWN IN FIG. 4

(b) *Watts Required*—Tables are available giving the watts per square foot for various classes of work. Care must be exercised in the use of such tables, as any given value of this constant, "Watts per square foot," applies to one type of lamp only. Thus, the "Watts per square foot" required to light a space adequately will be entirely different for tungsten and for carbon-filament lamps, because the lamps possess entirely different light-giving efficiencies; also, the value will change for the different types of reflectors and intensities. The area of floor space to be lighted is multiplied by the watts per square foot applying to particular conditions; the product indicates the total number of watts necessary to light the space satisfactorily.

(c) *Type and Size of Lamps*—Having determined the spacing of the lamps, which in turn determines the number of outlets, and also the number of watts necessary, divide the *watts required* by the *number of lamps* in order to ascertain the size of lamps.

(d) *Type and Size of Reflector or Globe*—In the use of tungsten lamps particularly, great economy results from the use of efficient reflectors. Glass and metal reflectors are now available that scientifically redirect the light rays of the lamp, and, when installed according to certain rules, they can be made to furnish light of uniform downward intensity over the working surface. Reflectors are now designed for use with specific sizes of lamps, and the proper shade or reflector holder should always be used with a given reflector and size of lamp. An inquiry addressed to a lamp manufacturer or one of the reflector-manufacturing companies is a ready method for securing information.

(e) *Hight of Lamps above Floor*—In general, lamps should be mounted as high as the ceiling will permit, so as to avoid glare and also to secure the best distribu-

FIG. 4. DISADVANTAGES OF DARK SURFACES AND ABSENCE OF LIGHT WALLS OVERCOME

FIG. 7. EXCESSIVE BELTING AND VERY DARK SURFACES

tion of the light. In some cases, however, it will be found advantageous to modify this general rule to secure a certain result. Fig. 1 shows a case of this kind.

(f) *Switch Control*—It is economical to control a small number of lamps on a convenient switch, particularly where a large number of small- or medium-sized lamps is used. This permits turning off the lamps when they are not required in certain parts of the room.

SEVERAL PRACTICAL CASES

Rules Modified for a Purpose—In the shop shown by Fig. 1, exception was taken to the rule that lamps should be mounted as high as the ceiling permits. The arrangement of the lamps in the foreground shows the original design. The lamps in the background are arranged according to the plan finally adopted. The lamps were lowered as shown and increased in size for the purpose of providing more side light on the machines and a higher intensity. Ordinarily, large lamps mounted as low as in this case would produce a bad glare of light, but in this instance the workmen look into the dark surfaces and openings of the machines and do not look into the lamps, which hang above and behind them.

The original plan, as shown by the lower elevation of Fig. 3, would have been excellent for a room where flat bench work exists and where the surroundings are light colored. Fig. 2 shows a location almost the same in general dimensions as that shown by Fig. 1, but in which light surfaces exist. This layout corresponds to the original plan of Fig. 1 and is excellent for the purpose and the surroundings. Fig. 3 shows the old and the new arrangement of the space

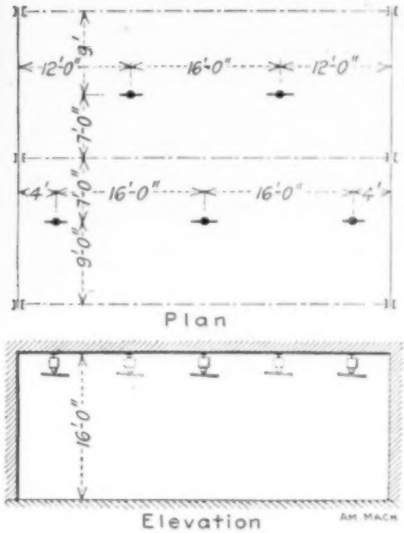


FIG. 8. THE LOCATION SHOWN IN FIG. 7

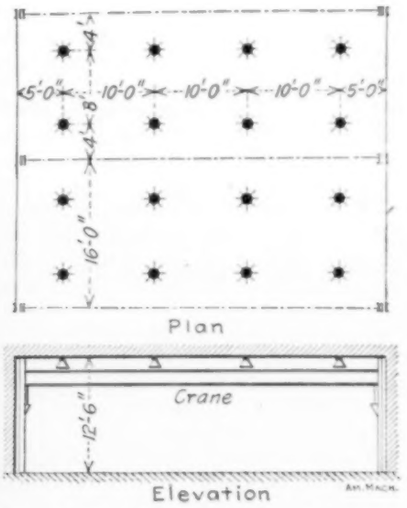


FIG. 10. THE SHOP LOCATION SHOWN IN FIG. 9

FIG. 9. CLEARANCE BETWEEN CRANE AND CEILING GOVERNS THE SIZE OF LAMPS

shown in Fig. 1. The difference between light and dark surroundings and surfaces is made plain by a comparison of Figs. 1 and 2.

The Effect of Dark Surfaces—Fig. 4 shows a shop in which the original lighting plan was symmetrical with the bays, as shown in Fig. 5. The intensity was not sufficient after the installation based on this design had been in service for a time, and since larger lamps were not

available, the old outlets were rearranged as shown in Fig. 6. The photograph, Fig. 4, was taken at night under the revised arrangement of lamps. Very dark surfaces and the absence of light walls were largely responsible for the change in this plan.

The Effect of Much Belting and Dark Surfaces—Fig. 7 shows a shop location where much belting and very dark surfaces exist. The original plans for a location similar to the one here shown, called for about 0.6 watt per square foot of floor space for the type of lamp used. After a trial this was increased to about 0.7 and, finally, to 0.8 watt per square foot, in order to provide a satisfactory light under the existing conditions. The indefinite amount of absorption of the light by belting and machines made the predetermination of the exact number and spacing of the lamps very difficult. Experiment and experience remedied the defect. Fig. 8 shows the plan and elevation of the space shown in Fig. 7, a photograph of this Cooper-Hewitt installation under the final arrangement of lamps.

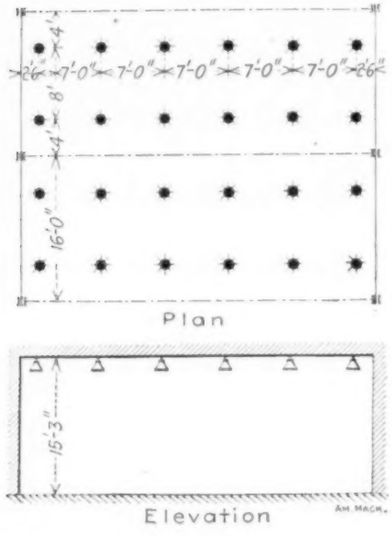


FIG. 11. THE ORIGINAL DESIGN WHICH WAS CHANGED. SEE FIG. 12

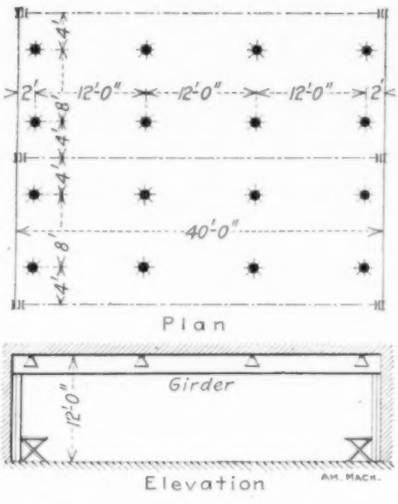


FIG. 13. THE ORIGINAL DESIGN. FIG. 14 SHOWS THE DESIGN FINALLY ADOPTED

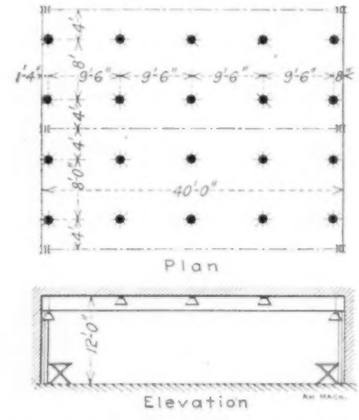


FIG. 14. THE DESIGN FINALLY ADOPTED IN PLACE OF DESIGN IN FIG. 13

The Factor of Crane Clearance—Fig. 9 is a photograph of a factory space taken at night, in which the clearance between crane and ceiling determined the size of the lamps that could be used. On account of the space limitations, tungsten lamps of the 100-watt size were about the only lamps available that could be used here. Fig. 10 shows a plan and elevation of the location, Fig. 9.

A Preliminary and a Final Design—Fig. 11 shows the preliminary design for a certain factory space, while Fig. 12 shows the final plan for the same. The final plan was adopted largely because of its better appearance and general symmetry, as compared to Fig. 11, and also because the first plan called for more lamps than were actually necessary. A careful study of the original plans effected a saving of about 20 per cent. in the cost of the installation.

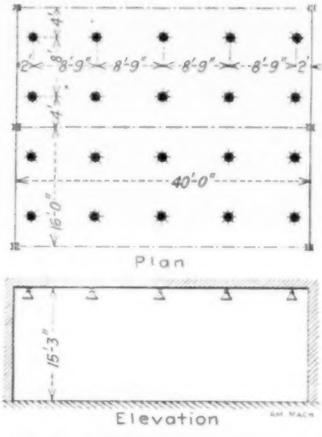


FIG. 12. THE FINAL PLAN REVISED FROM THAT SHOWN IN FIG. 11

Tall Machines as a Factor—Fig. 13 indicates the original plan for a low-ceiling machine shop where tall machines and

FIG. 15. TUNGSTEN LAMPS WITH METAL REFLECTORS INSTALLED AT THE CEILING

FIG. 16. THE SAME AS FIG. 15 BUT WITH GLASS REFLECTORS

very dark surfaces occur. This scheme was installed, but did not fulfil the requirements. Fig. 14 shows the final scheme, which gave satisfactory results over the entire floor space. An apparently minor change of this kind will often make a great difference in the ease with which work can be performed under the artificial lighting.

Ceiling Reflection as a Fact —Fig. 15 is a night photograph of a factory space where metal reflectors were in service for a time. Note the dark ceiling. Practically all of the light on the floor and machines comes from the inside surface of the metal reflector. Fig. 16 shows the same location as that shown in Fig. 15, but with glass reflectors. Here an additional amount of light is thrown on the floor, due to the ceiling reflection; besides, a much more cheerful appearance of the location is produced.

Summary

From the foregoing practical instances it will be seen that a first design is not always, nor is it likely to be, the most satisfactory. Where much experience precedes the design of shop lighting, however, satisfactory results are quite possible, and numerous cases might be cited where the original design was entirely satisfactory.

Enough has been presented relative to the scientific planning of shop-lighting systems to convey the idea that the complicacy of the problem tends to make the solution difficult. It is true that the variable factors tend to make a predetermination of results uncertain and sometimes impossible, but this is often and most generally due to inexperience.

When making a first installation under any given conditions, the novice can hardly expect to possess a grasp on all these conditions sufficiently to insure the successful solution of the problem. The specialist who has planned out and installed numerous other systems similar to any given case in hand is assuredly the most competent to undertake such a design and to foretell the result.

The foreman is a good barometer of the efficiency of a shop's system of management. If he is going about in the even tenor of his way, seeing that supplies are coming right for his men and taking care of emergencies without losing his head, he is usually working under a system which is elastic enough to be called good. But where you find a foreman hopping around like a turkey on a hot brick, men standing around waiting for jobs, you can generally count on finding a cast-iron system that has slipped a cog. While it is just possible that it is a case of poor foreman, the best foreman in the world can do little when he is allowed no discretion with which to handle emergencies.

Ordering and Keeping Wheels

By W. G. Groocock

Systematic coöperation between the purchasing department and the men in the works will obviate a good deal of the difficulty that frequently occurs in the keeping of a stock of wheels.

In the first place, the wheels in use on the various machines should be tabulated, and this tabulation should be kept up as new machines are added. Secondly, the selection of wheels should be left entirely in the hands of one man, preferably in the hands of the man who is responsible for the grinding. The foreman in charge of the grinding should be permitted to experiment with different wheels; then, he can intelligently choose the most suitable wheels on the basis of the data gained during these experiments.

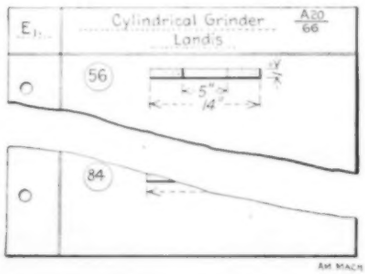
In keeping a record of the various wheels required, I believe it is best to place a sketch of each wheel used on a particular machine on the data sheet or card. The accompanying figure shows a card that I have used for this purpose. In the corner, there is a combination number representing the machines it is compiled for. Each of the wheel sections shown, also has a number in circle allotted to it. This number represents the department ordering number for that particular wheel; when several machines take the same size wheel the sketch representing that wheel on the various cards will carry the same departmental number.

In conjunction with these data sheets a master sheet or book is required on which should be given all particulars as to the code number for each firm, the number of machines the wheels are used on, the number of wheels in stock at certain periods, the estimated yearly requirements, and the number on order at a given time. Such a sheet is illustrated in the accompanying table. This record should preclude overstocking and should be a ready means of pointing ways to economy.

Take, for instance, items 61 and 62 in the accompanying table. These are both wheels for surface grinders, in two different shops, for doing practically the same work; consequently the grade and grain are interchangeable. However, the bores of the wheels have different diameters, because they are used on different makes of machines. Of course, in such a case a very slight alteration of the wheel arbor of one of the machines will eliminate one of the wheels. Consulting the cards from time to time will reveal similar little economies that can be effected. The cards can also be very useful to the purchasing department.

In ordering wheels great care should be taken to make the specifications complete. For instance: Landis YY is a 14x1x5-inch wheel, while Brown & Sharpe YY is a 12x1x5-inch wheel. There should be given not only the grains and grades, but the shapes, the numbers, and the firm who makes the wheels; for positive certainty, the size also should be given.

Department Number	Size of Wheel, Inches	Number of Machines Using Wheel	Estimated Yearly Requirements	Stock Record 1-4-12							
				In Hand	On Order	In Hand	On Order	In Hand	On Order	In Hand	On Order
55	18x1½x8	1	3	14	0						
56	14x1 x5	2	6	16	2						
57	14x ¾x5	2	1	6	0						
58	12x1 x5	1	4	4	0						
59	12x ¾x5	1	1	18	0						
60	12x ½x5	1	1	3	0						
61	12x2 x9	1	5	4	4						
62	12x2 x4½	1	5	3	0						



A Typical Card

Conservatism seems to be most prevalent in the field of engineering. More really foolish practices than you can readily enumerate endure simply because most men are afraid to attempt to reason for themselves and break away from the ways established by their forefathers. Salesmen appreciate the truth of this, perhaps, more than the men of any other class. Ask any man who is trying to sell some device that is based on a new idea or that departs from customary lines to verify this.

From statistics compiled by the American Iron and Steel Association it is noted that the total mileage of railroads in 1909 was 625,706 miles, of which North America supplies 277,015 miles against 287,513 for Europe, Asia and Africa.

An Analysis of Power Requirements

By Curtiss F. Smith

A method of analyzing the power requirements of the various departments of a manufacturing works, which establishes a basis for computing the motor sizes in changing from mechanical transmission to electric-motor drive.

In making the motor installation for a large manufacturing works, employing 1200 men, in the Middle West, it was desired to use motors of not over 50 horsepower each. Still it was necessary to make a thorough analysis of the power requirements of the various departments. The results were obtained by indicator cards from the engines; that is, by cutting out sections of shafting and departments as necessary to obtain differences of power before and after cutting out such sections. These engine tests covered a period of about six weeks, and were conducted at a time when work was slack.

About 90 per cent. of the work in the plant under discussion is piece work, which made the testing difficult at times.

Four labor difficulties were encountered:

I. Obtaining in the section to be tested a full quota of employees at the time of the test.

II. Making the tests at the hours of maximum power consumption, as certain periods were allowed for morning lunch and for weighing in the employees' output; also, the more rapid workers and forge-shop employees left early.

III. Stopping the engine for uncoupling shafting, and cutting, or throwing off belts quickly, in order not to cause dissatisfaction among the piece workers and their consequent liability to quit early or "soldier" for spite during tests.

IV. Making the tests without letting the employees know in advance the date or time of day; otherwise, many would remain away for the day, as with the frequent stops for disconnection their output would be small.

Description of the Factory

The works are divided into two sections by a central, four-story, brick warehouse containing offices in the front. Department X, on the north side of this, consists of a three-story frame building, in which there are an engine and boiler, and which uses power on all three floors; a one-story forge shop and an addition nicknamed the "kitchen"; and a smaller three-story building, which has power on the two upper floors only. Department Z, on the south side, consists of two buildings, a four-story frame building and a two-story frame building with a one-story forge shop and its "kitchen" addition. Power is used on all floors of these buildings.

Planning the Work

Before starting the engine tests, it was necessary to plan a method of procedure and to have everything in readiness. This necessitated complete diagrams of all shafting and connections, including couplings and connecting belts. Schedules of section cut-outs for each day's tests were then made and followed as closely as possible. For the work, there were required: a man in charge, an assistant at the engine for taking cards, an errand boy to carry instructions to the assistant, and the millwright with two helpers for disconnecting shafting and belts.

The Original Power

Fig. 1 is a diagram of the power layout in Department X, line shafts and side shafts only being shown, with intermediate shafts connecting the mains wherever they occurred. Only the couplings that were cut are shown. Loose pulleys are indicated by projections beyond the belts shown and clutches by a conical section and operating lever.

The power for Department X was supplied by a 22x48-inch Fitchburg engine running 64 revolutions per minute on about 85 pounds pressure at the engine. The belts connecting the main lineshaft with shafts on the second and third floors were endless, with cemented joints, and it was not desirable to cut these. It was possible to throw off some of the smaller belts, and the laced belts could always be cut at the lacing. The period for tests requiring this was taken to bring such cutting and consequent time for relacing at noon time or evening; this closed that section for only a short while.

Determining the Sizes of Sections for Power Units

To secure a basis on which to determine the number and approximate sizes of meters, it was necessary to make preliminary tests to ascertain the amount of power used on each floor.

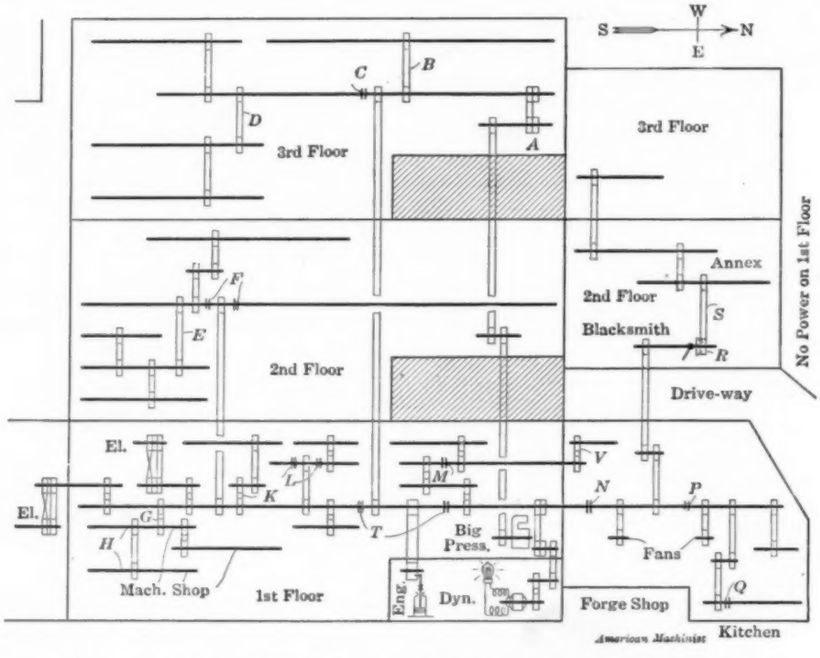


FIG. 1. DIAGRAM OF THE TRANSMISSION LAYOUT IN DEPARTMENT X

The method of finding the power consumed per floor was to get the power with the floor in operation, then with it cut off; the difference was the power used on that floor. Of course, it was extremely important that the other floors should be running the same after as before cutting off the floor being tested. The actual power these other floors or departments were using had no bearing on the section being tested, provided they were constant in their power consumption. With the assistant at the engine taking cards, the man in charge could devote his time to keeping close watch on all the sections driven by the engine

being tested and could see that the power consumption remained as nearly constant throughout the tests as possible.

Cards were taken at five-minute intervals, ordinarily six cards to a section, which gave about half-an-hour's run to a test; a preliminary 10-minute interval was allowed for all machines to be brought into working order and from 10 to 20 minutes to disconnect belts or shaft couplings. This gave from three-quarters of an hour to an hour for each test. It was possible to run off some of the tests in shorter time when the work was uniform and no preliminary preparation was necessary, and particularly when to disconnect the section meant simply running off or cutting a laced belt.

Short Cut in Figuring Indicator Cards

The cards were all taken with a Crosby indicator with the reducing-wheel attachment and a 50-pound spring, which gave 4-inch cards for all the engines. The areas were obtained with a planimeter.

With a constant-length card and spring, it was easy to resolve the horsepower formula into a constant with only the area of the card and the speed the variables for the various engines.

As all three engines were overloaded, the speed varied slightly with the load, and, therefore, constituted a variable in the equation.

The formula used was the simple one:

$$H.P. = \frac{PLAN}{33{,}000} \qquad (1)$$

Calculating the results from the readings obtained might seem a very formidable task, but this was simplified by developing for each of the various engines a single constant from the various constant factors and using a slide rule in connection with this constant and the readings taken.

The Preliminary Tests

For the preliminary tests of complete floors, no written schedule was necessary, as there were only a few tests to each engine. Department X was taken first. Each foreman had instructions to see that his department continued as steadily as possible, and that the same amount of work was being done when the engine started again each time as before it stopped for disconnections. During these tests, notes were made of the approximate percentage of the maximum power possible that was being consumed at the time. Upon these percentages was based the maximum power required for a floor.

Before describing the tests, it might be well to say a word of precaution to anyone undertaking similar work. *Test your indicator.* This is very easily done, and will sometimes save doing the work all over again. The springs are usually very accurate, but the piston is liable to become scored, and, consequently, to register a lower pressure. Also, be sure that the indicator piston is properly seated against the end of the rod, so that it is square in the cylinder.

The first test was to determine the power used by the entire forge shop and the drive across the roadway. Cards were taken with all the departments running; the coupling *N*, Fig. 1, was then disconnected and another set taken. The results were as follows:

(I)	All Running	*N* Cut
	200.9 h.p.	168.3
	229.7	171.4
	254.3	175.5
	256.5	177.5
	256.8	178.9
	.....	181.4
	5)1,198.2	6)1,053.0
	239.6 average	175.5 average

239.6 — 175.5 = 64.1 *h.p.*

During this test, it was not convenient to disconnect the drive across the roadway first, and it was imperative to test the forge shop at this time, as work would be slack the next day and for some time afterward; hence, a test was taken the following day to determine the power delivered across the roadway.

(II)	All	*S* Cut
	221.6	214.5
	224.4	215.8
	232.5	219.6
	234.0	225.7
	248.7	237.5
	5)1,161.2	5)1,113.1
	232.24 average	222.62 average

232.24 — 222.62 = 9.62 *h.p.*

The conditions were identical with those of the previous day, at the time of Test I; hence,

$$64.1 - 9.62 = 54.48$$

horsepower, the power required for the forge shop.

TEST I

Test	Running	Maximum
54.48 h.p.	75%	72.6 h.p.

TEST II

Test	Running	Maximum
9.62 h.p.	80%	12 h.p.

These two tests are given in detail to explain the method of procedure, but in those that follow, only the averages and final results are given.

For the third-floor test, the big press, shown on the first floor, but driven from the third floor, was stopped, as it made only 5½ strokes per minute and the work was so heavy that it would be liable to give bad results; furthermore, a separate motor was to be installed to drive it; hence, the power consumed was not desired in this test. The driving belt from the first floor was a 24-inch endless belt; hence, for the cut, the coupling *C* was disconnected and the belt *B* thrown off.

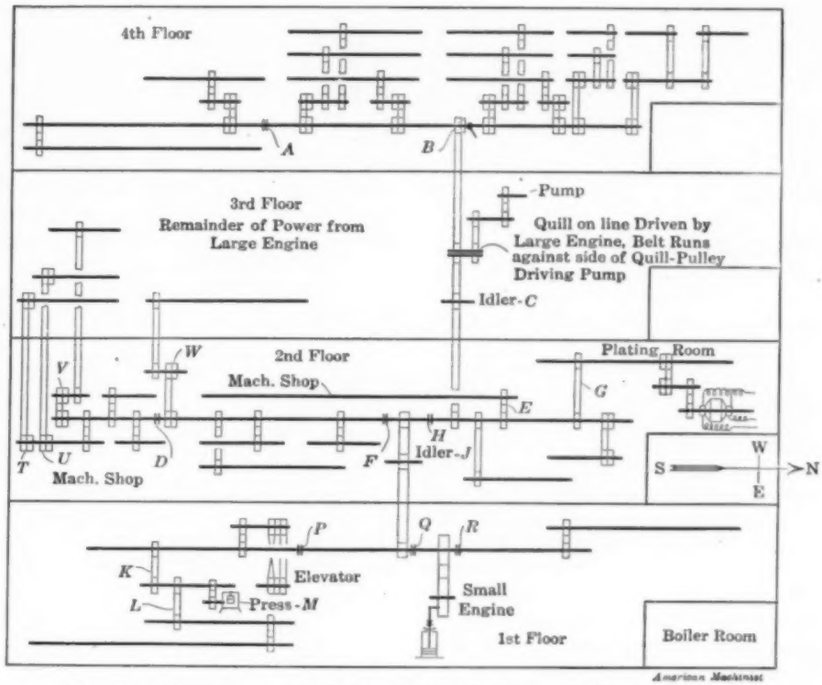


FIG. 2. DIAGRAM OF THE TRANSMISSION LAYOUT IN DEPARTMENT Z

TEST III

Averages All	*B & C* Off	Difference	Running	Maximum
232.24 h.p.	193.5 h.p.	38.74 h.p.	75%	51.7 h.p.

The driving-belt conditions for the second floor were the same as those for the third; hence, the couplings *F* were disconnected.

TEST IV

All	*B & C* Off	Difference	Running	Maximum
229.34 h.p.	204.87 h.p.	24.47 h.p.	65%	37.7 h.p.

The first floor had to be arrived at by a little more figuring:

Total Average Loads		Test Loads	
(I)	239.60	(I)	54.48
(II)	232.24	(II)	9.62
(IV)	229.34	(III)	38.74
	3)701.18	(IV)	24.47
	233.73 average		127.31

233.73 — 127.31 = 106.42 horsepower includes engine, lighting generator, two large belts, and two elevators.

Estimated power, generator from main line	21	h.p.
Second-floor belt, estimated	6	
Two elevators, estimated continuous average	6	
Engine friction, obtained by indicator on Sunday by disconnecting couplings *T*, which includes third-floor belt	20.2	
	53.2	h.p.

TEST V

	Running	Maximum
106.42 — 53.2 = 53.22 h.p.	20%	66.5 h.p.

Tests VI to XIII in Department Z, Figs. 2 and 3, were made in the same manner.

Determining the Number of Motors

A basis of 30 horsepower per motor was decided upon as a convenient motor size.

In Department X, Fig. 1, the following were decided upon:

Test No.	Actual Test	Maximum Power	Number of Motors
I	54.48 h.p.	72.6 h.p.	3
II	9.62	12	1
III	38.74	55.4	2
IV	24.47	37.7	2
V	53.22	66.5	3
Department Z, Fig. 2:			
VI	57	81.5	3
VII	37.36	44	2
VIII	14.99	21.4	1
IX	66.60	74	3
Department Z, Fig. 3:			
X	32.8	47	2
XI	12.3	13	1
XII	53.5	71.3	3
XIII	114.3	120.3	4

Several smaller motors were required for pumps and a fan, one large motor for the big press in Department X, one for the plating room, and a separate one for the machine shop on the second floor, Fig. 3.

If a department was small enough for one motor, the cutting-solution pump drive was retained by belt; but if a room had more than one motor, it was necessary to install an electric pump, in order to supply any part of the room that might be operating alone.

The "Split Tests"

Having reached a decision as to the number of motors and the section to be driven by each, it was then necessary to make actual power tests of these sections by splitting up each room accordingly. In these tests, the actual number of machines in operation and idle, and their sizes, were noted, to obtain the maximum power required. In most cases the motor decided upon was a little larger than required. Where there was room for building, as in the cases of the old engine and boiler rooms, and where there was any spare space or a possibility of placing new machines, the nearest motor was made large enough to anticipate such additional requirement of power. But where a section was overcrowded, the motor for that section was made just large enough for the work, as no more could be added, and the motors could stand a continuous overload of 25 per cent. at a slight sacrifice of efficiency.

The "split tests" were made in the same manner as the first ones, except that extreme care was taken to obtain accurate results. Special preparations were made to supply work enough to keep the power steady during such tests as were carried on in one day.

Ordinarily, only one set of cards was taken at each shafting or belt cut; the difference between any two tests showed the power used. But in a few cases, two sets had to be taken. If the work was insufficient to maintain a uniform load throughout a series of tests, that section was run light until all others above it were cut out. Then this section was loaded up, tested, and cut out.

A check was obtained on the final tests by making a comparative table of the maximum powers from the preliminary and split tests. The results are shown in the accompanying table.

It will be seen that the results agree quite closely, the final tests being a trifle larger, as more care was taken on them to consider everything affecting the maximum power that might be used. Test X was incorrect in the preliminaries. During these tests, the lower floor, which has very heavy machinery, was in operation, and at the time of stopping to disconnect, after indicating for Test X, two of the largest machines were put out of commission; hence, on starting *C* again without them, their power was indicated with Test X, which consequently was greatly in excess of what it should have been.

Schedule for a Test

The schedule below shows what can be done if a study is made of the conditions and the work systematized. It was made out for the split tests on the small engine in Department Z, and beaten by over one hour, the last cards being taken at 4.45 p.m. instead of 5.50 p.m., as called for.

It will be seen that the first floor was taken first, with the remainder cut out. The reason for this was that, on account of the large amount of power consumed here, there was a liability to variation that would greatly affect the smaller amounts if included in them; consequently, after this floor was tested, it was left disconnected and the others taken with extremely satisfactory results.

In several cases, "before and after" cards were necessary, illustrations being cards *G* and *H*, *I* and *K*, and *M* and *N*. In these cases it was necessary to take the cards after the cut, with the remaining sections operating as before, the next

Test No	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Section—*a*	25	11.75	18.50	13.30	15	23.30	11.10	24.40	19.50	14.30	18	24.20	11.90
Section—*b*	20		35.80	29	30.50	13	28.90		27.40	16.70		30.30	36.70
Section—*c*	11				12.90	42.20			35.60			33.70	28
Section—*d*													55
Total final	86.00	11.75	54.30	42.30	58.40	78.50	40.00	24.40	82.50	31.00	18.00	88.20	131.60
Preliminary	72.60	12.00	51.70	37.70	66.50	81.50	44.00	21.40	74.00	17.00	13.00	71.30	120.30

TABLE 1. COMPARISON OF PRELIMINARY AND FINAL TESTS

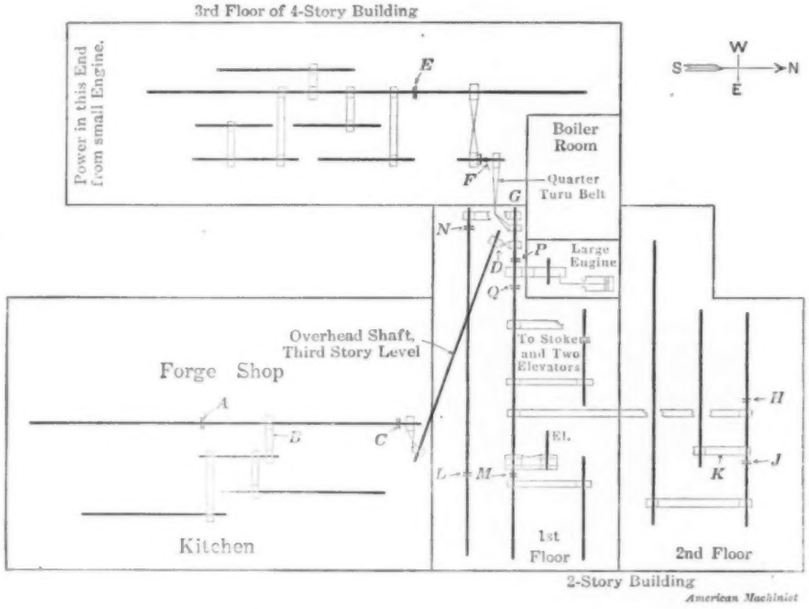


FIG. 3. DIAGRAM OF THE TRANSMISSION LAYOUT IN DEPARTMENT Z

cards being taken with the section to be tested operating at full load.

It was necessary to be "on the job" every minute during these tests, as an error or misunderstanding would mean stopping the entire department another time and uncoupling and coupling again to get one particular section, which would probably spoil an afternoon. The entire 15 sets of cards in this particular case were obtained in four hours and twenty minutes, many of the disconnected sections being connected again, back of the last cut, while the next cards were being taken.

For the tests shown in Table 2, there were taken 87 cards, about six cards per section, except *P* and *Q*, which were for friction only; in this case, as the power was constant, only two or three were needed.

As the tests were completed and the cards figured, the results, as shown for Test I at the beginning of the preliminary tests, were placed in detail on a plan of the entire factory-power layout. All averaging and figuring were done on the section of each test, and the motor numbers and sizes were also marked at their approximate locations. The tracing was approximately to scale, 20 feet to 1 inch, and prints of it were of great value on which to mark shaft speeds, motor and countershaft locations, and necessary details for the motor installation.

SCHEDULE FOR TESTS ON SMALL ENGINE, DEPARTMENT Z. FIG. 2, FOR THURSDAY, OCT. 27, 1910

Time	Card	Cards Taken	Test	Diff for Power	Location	Operation	Actual Time
Noon						Slack idler *J*	Noon
12.30	A	7	XIII—*a*	A–B	South end corner, first floor	Cut belt *L*	12.44
12.45							
12.55	B	6	XIII—*b*	B–C	South end, first floor	Cut coupling *P*	12.57
1.10							
1.25	C	6	XIII—*c*	C–D	North end, first floor	Cut coupling *R*	1.14
1.40							
1.55	D	6	XIII—*d*	D–Q	Center, first floor	Tighten idler *J*	1.30
2.10							
2.15	E	6	X—*a*	E–F	South end, fourth floor	Cut coupling *A*	1.50
2.30							
2.45	F	6	X—*b*	F–G	North end, fourth floor	Clutch *B* out	2.14
3.00							
3.05	G	8			Clutch out for X-*b*	Slack idler *C*	2.24
3.10							
3.15	H	6	XI—*a*	H–J	South end, third floor	Belts on loose pulleys, *T*, *U*, *V* & *W*	2.33
3.30							
3.35	J	6			Loose pulleys for XI-*a*	Load up machine shop	2.50
3.50							
4.00	K	6	XII—*a*	K–L	Machine shop, second floor	Cut { Coupling *D* / Belt *E*	3.08
4.15							
4.25	L	6	XII—*b*	L–M	Center, second floor	Cut coupling *F*	3.33
4.40							
5.05	M	6			Coupling cut for XII-*b*	Load north end	3.55
5.15							
5.20	N	7	XII—*c*	N–P	North end, second floor	Cut coupling *H*	4.06
5.35							
5.40	P	2		P–Q	Belt friction	Slack idler *J*	4.35
5.45							
5.50	Q	3		Q	Engine and belt friction		4.45

TABLE 2

THE MOTOR INSTALLATION

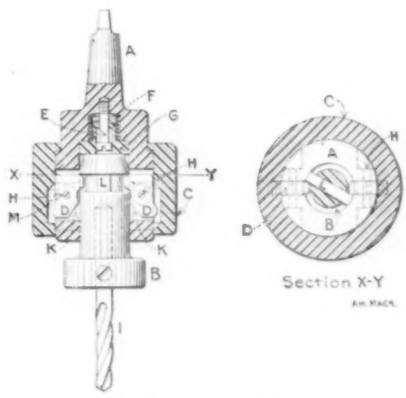
The installation of the motors presented a long, tedious problem, involving location, speed, pulley and belt sizes, and many other considerations affected by the congested conditions of the factory. This work was fully as interesting as the testing and presented many calculations that were quickly and easily disposed of by reducing them to simple terms, constants, or proportions, and solving them on the slide rule.

Chuck that Permits Changes of Drills while Running

BY EDWARD SOBOLEWSKI

The drill holder *B*, in the accompanying figure, is fitted to the drill *I*, which has a flat milled on one side, and each drill of the various sizes used on the work is kept in one of these holders.

When the operator is finished with one drill, without stopping the drill press, he takes hold of the collar *C* and pushes it upward, thus releasing the drill holder *B*. Then he inserts another drill and drops the collar *C*; the drill is then in place, and the operator can go ahead with another drilling. Thus, he saves considerable time that is usually lost in rechucking.



A DRILL CHUCK

In the accompanying figure, *A* represents a tapered shank made to fit the drill-press spindle; and *C* is a nurled collar made to revolve easily on the shank *A*. This collar has a cavity *M* cut on the inside so as not to interfere with the round projecting parts on the fingers *D D*. The fingers *D D* are pivoted on the pins *H H*, and serve to drive the holder *B* by means of the driving bar *L*, which is inserted in a slot cut in *B*. The collar *C* fits over the upper outside edges of fingers *D D*, and prevents the fingers from turning outward while in operation. The bushing *G* is made the same size as the shank of holder *B*, and is held in place by the screw *E*; the spring F tends to push *G* downward, thus always holding *B* down against the fingers *D D*. It also serves to throw out *B* when another drill is being inserted.

The collar *C* can be held stationary in any position while the rest of the chuck revolves, and, as there are no setscrews or other projections, the operator need have no fear of tearing his hands.

The chuck is constructed entirely of steel and very few of its parts are subject to wear. It will take drills of a wide range of sizes, and will save considerable time in changing drills.

Gyroscopic Control of Aëroplanes

Some interesting experiments have been conducted in France with gyroscopes applied to aëroplanes.

The gyroscopes used weighed about 11 pounds and rotated at 6000 revolutions per minute. The gyrostatic action was used to cause rudders to work automatically. Experiments with a fixed apparatus were tried in a uniform air current, and also in the variable winds at the top of the Eiffel tower. It was found that the gyroscope with its pivoted frame tended to acquire an oscillatory movement, which was overcome by the use of damping planes immersed in water. This difficulty was not experienced when the apparatus was applied to gliders, 472 inches square in area, the planes themselves being sufficient to damp the oscillations. The gyroscopic governor successfully compensated for disturbances of balance due to distribution of load and to variable winds and was used to advantage in a motor-driven aëroplane.

The adoption of oil fuel, except in localities where coal is excessively dear and oil relatively cheap, is progressing very slowly, in spite of many advantages, such as ease of handling, cleanliness, and flexibility of operation. This is due largely to its general inability to compete in part with the lower grades of coal that are now being burned successfully, and to the relatively limited supply.

Tests of Lubricating Greases

By G. W. Lewis *

Results of tests on a large number of greases give the coefficients of frictions and rise in bearing temperature. Also a number of simple tests that can be made by the user to determine the character of a grease under consideration.

*Assistant professor, department of engineering, Swarthmore College.

An ideal lubricant is a greasy material that will form a continuous, coherent, durable film capable of holding apart rolling or sliding surfaces with the least possible resistance, and without gumming the bearing or injuring it by the presence of free acids, alkalis, etc.

Every grease manufacturer should try to produce such a lubricant, but many are unscrupulous and turn out a very inferior product.

There are two general types of greases: the so called mineral and the animal or tallow greases. Mineral grease should be made from a high-grade refined petroleum oil and so treated that the least possible amount of foreign substances be used to bring it to a solid state. Lime soap is generally used and the mixture emulsified by mechanical stirring or blowing air through the mixture. Some manufacturers use resin, resinous oils, graphite, soapstone, wax, talc, powdered mica, and asbestos, which are introduced into the grease for the purpose of creating an artificial body.

Tallow greases should consist of some hard vegetable or animal fat, such as tallow, with a small amount of mineral oil. Here the mixture is solidified by the use of a soap, in this case a potash soap being usually used. The melting temperature of tallow grease is from 50 to 75 degrees Fahrenheit lower than the melting temperature of the mineral grease. Some very inferior greases are made from oils which are the waste of soap factories and sewage-disposal systems.

All greases look good when the can is opened and nearly all will work well on a bearing for a short time. Then a poor grease will cause the bearing to heat, which decomposes the grease into oil and soap, especially if the per cent. of soap is high, and impurities have been used. Any adulterants used continually accumulate in the bearings as the grease melts away, and cause gumming and sometimes scoring of the bearing.

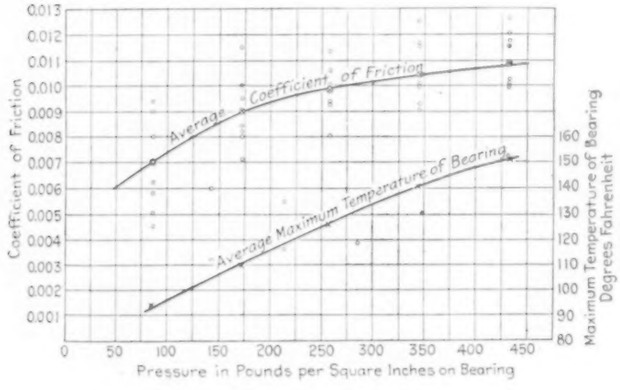

Coefficient of Friction
Average Coefficient of Friction
Average Maximum Temperature of Bearing
Maximum Temperature of Bearing Degrees Fahrenheit
Pressure in Pounds per Square Inches on Bearing

FIG. 1. AVERAGE CHARACTERISTIC CURVES FOR NINE GREASES

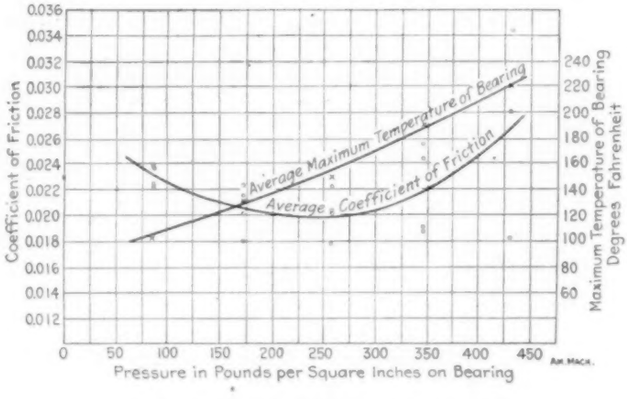

Coefficient of Friction
Average Maximum Temperature of Bearing
Average Coefficient of Friction
Maximum Temperature of Bearing Degrees Fahrenheit
Pressure in Pounds per Square Inches on Bearing
AM. MACH.

FIG. 2. AVERAGE CHARACTERISTIC CURVES FOR FOUR GREASES

SIMPLE TESTS FOR GREASES

The consumer, to protect himself, should make the following simple tests on any grease he contemplates using: Tests for acids, alkalis, volatile matter, filling, water and gumming.

The test for free acid is best made by melting a small quantity of grease and applying blue litmus paper. The test for alkali is made in the same way by applying red litmus paper.

The test for volatile matter, such as naphtha or benzine, is made by heating a measured quantity to 150 to 200 degrees Fahrenheit and determining by weight the amount volatilized.

The test for filling, or the amount of soap or other material used to form a body, can be partially determined by melting a test tube of the grease to a liquid state and noting the amount of residue or cloudiness in the bottom of the tube, which gives an idea of the amount of soap or other material used in bringing the grease to a solid state. A more accurate test is to take a small sample of grease and dissolve in gasolene, then add phosphoric acid in alcohol solution and if any soap is present, it will precipitate and give a relative idea of the amount in the grease.

To determine the amount of water in the grease and to see if it will "wash out," place a small amount in a linen cloth or a common handkerchief, fold in the form of a bag, and place in water and knead for five minutes. In this way the amount of water present can be determined; also if the grease will wash out which is very important, especially in paper making and laundry machines where water comes in contact with the bearings.

The simplest method to determine the amount of gumming is to take a sherry glass, put in a few pieces of copper wire and add concentrated nitric acid. Then add the grease in finely divided particles to the solution, stirring until all the grease has been broken up. In the case of a tallow grease the tallow will form a solid crust on top of the liquid in about an hour; with a vegetable oil the oil remaining will be about the consistency of butter, while with a mineral oil the oil remains in a liquid state. The blackish substance that appears below the oil represents the impurities that cause gumming of the bearing. Next separate the acid from the oil and the black substance and add gasolene to the two latter. This washes out the oil and separates the gumming substances so that a fair idea of the quantity in the grease can be obtained.

RECORD OF GREASE TESTS

The accompanying 74 tests were made on an Olsen oil and grease testing machine using a babbitt bearing on a steel journal. The grease to be tested was fed through an appropriate grease cup to the center of the bearing shoe and distributed by conventional grooving. The shoe is drilled to contain the thermometer for obtaining the temperature of the bearing.

The tests have been divided into two groups. In the first group the greases were fed at such a rate as would maintain in each case the lowest coefficient of friction possible with the grease used. This method corresponds to an oil test where the bearing is run in a bath of oil. In the second group, the grease was fed at regular intervals, every 10 minutes and only a small quantity at a time, which corresponds to an oil test where so many drops are fed per minute. These different methods of feeding the grease account for the variation in the coefficient of friction, temperature of the bearing, etc., as seen from the table and curves.

In plotting the average curves for Fig. 1, tests 1 to 6 were omitted, as they gave very low values for the coefficient of friction. In plotting the average curves for Fig. 2, tests 67 and 68 were omitted, as the values of the coefficient of friction were very high. The tests represent seven of the best makes of greases, and the results show that there is not a great difference as to their lubricating quality. However, a grease may give good results on a testing machine, but if run for a week or so may show very poor results due to impurities.

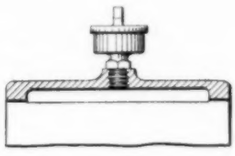


FIG. 3. GREASE POCKET IN BEARING CAP

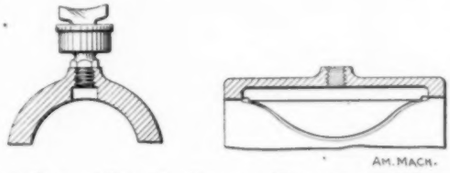


FIG. 4. GREASE GROOVES IN BEARINGS

GREASE CUPS

Grease cups are used to distribute grease to the bearing. There are three types: The hand compression cup for slow moving or stationary bearings; the spring or automatic feed cup for bearings of high velocities where it is impossible to make an adjustment when the bearing is in motion; grease cups that use a copper rod running from the bearing up into the cup, in some cases to carry heat from the bearing to melt the grease, and in others to assist the flow of grease by vibration. In ordinary bearings, one cup will lubricate eight inches of bearing length; above that two should be used up to 16 inches. In lubricating with grease, the upper part of the bearing cap should be cut out so as to leave a reservoir or storage for the grease as per Fig. 3.

The bearing should be grooved as in Fig. 4 to catch the grease that melts, which always has a tendency to work to the outside of the bearing. The grooves carry it back to the center. In lubricating sliding surfaces, it is generally advisable to place the grease cup on the moving member. Feed holes from the same cup should never be made of unequal length, as the shortest will get all of the grease.

A Homemade Governor for a Gas Engine

BY E. Q. WILLIAMS

On account of the stopping of the motor which supplied us with power, it became necessary for us to have power and have it quick, and as the only resource available was a 1½-horsepower, two-cycle boat engine, this was pressed into service and arranged to run on ordinary gas. This did fairly well, but as there was no way of governing it, the consequence was that it either raced badly or stopped, so that a governor was a necessity. We thought it over a lot, and finally evolved the following, which has been very satisfactory.

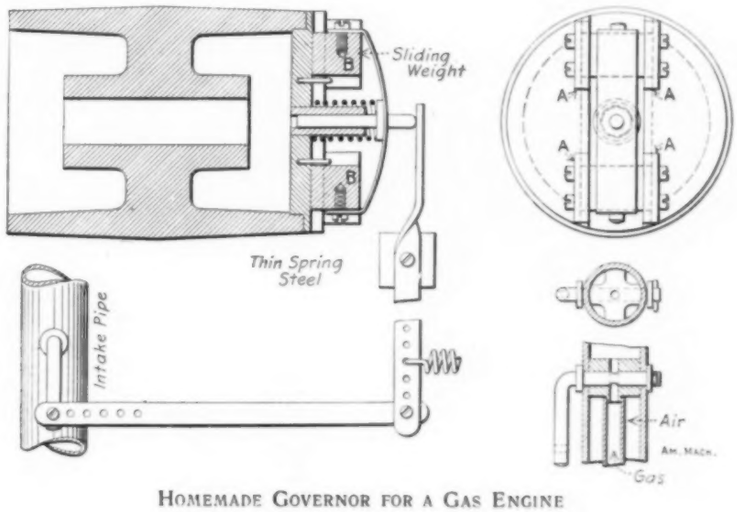
The engine was a 3x3 vertical cylinder, standing on a 7-inch base; the drive pulley was 6 inches in diameter, and one end of this was bored out true; then a disk of cast iron about ¾ inch thick was turned to fit this with a dovetail groove planed in, as shown. A couple of blocks of cast iron were planed to fit this groove, so that they would slide easily in it.

In the center of the disk a hole was drilled and a round guide inserted to carry a sliding pin; this pin had a shoulder on it, behind which a helical spring was placed to keep it out against a thin clock spring which connected the two weights together. As the pin pushed this thin spring out, it drew the two weights toward the center, but when the engine was running the centrifugal force threw them apart and drew in on the spring, thus pressing the pin back into its socket. This gave us an end motion of about ⅛ inch.

Our carbureter or mixer consisted of a piece of 1-inch gas pipe screwed into an ell on the intake of the engine so that it stood vertically. To make a throttle, a four-armed piece of brass was turned to fit the pipe, a horizontal hole was drilled through this and the pipe so that a piece of ¼-inch round iron would turn easily in it. Another hole was drilled through the brass and the iron rod vertically for the gas to pass through, so that by turning the bent arm of the throttle rod the gas could be on full head, or could be turned off.

Connection was made between the arm of the throttle and the moving point on the governor by a couple of pieces of ⅛-inch iron, as shown. The first point was placed so as to make it about 4 to 1 motion, but in another I would make it greater, so as to make the throttle answer quicker.

We found that the weights were too light, and the center of gravity too far in, so that there was some difficulty from the sticking of the weights in the grooves. This was remedied by cutting off four pieces of cold-rolled stock and fastening them on at *A A A A*. Another trouble was that our hole through the throttle was too small for the size of the gas hole, and it had to turn too far to shut off. Making it 5/16 remedied this, and it is working nicely now. The whole job took less than one-half day for one man.



HOMEMADE GOVERNOR FOR A GAS ENGINE

From a preliminary report by the Bureau of Census covering the automobile industry in the United States, it is noted that the number of establishments manufacturing automobiles increased from 57 in 1899 to 316 in 1909, an increase of 454 per cent. in the 10-year period. Of the 316 establishments in 1909, 265 manufactured automobiles as a main product, while complete machines were a minor product with 51 of the establishments.

Gyroscopic Control of Ship Rolling

By Henry Hess *

A practical application of the gyroscopic principle to counteract the forces that produce ship rolling.

A successful experiment that reduced amplitude of the roll by two-thirds.

Many efforts have been directed toward the prevention of "rolling" of ships at sea. Considerable success is now attending these efforts, not on models only, but on full-sized vessels in regular service. The devices used are of two types, popularly referred to by the names of the engineers most prominently identified with their development.

Application of Gyroscope

Frahm employs trimming tanks in such a way as to cause a rapid transfer of water to counteract the forces that produce rolling. Schlick uses the gyroscope to counteract these forces. Though the suggestion is old, Schlick was the first to give it practical shape and the first to demonstrate its value on a small scale and now on vessels of considerable size.

The Hamburg-built steamer "Schaarhörn" has a length of 123 feet, a beam of 22 feet, and draws 8¾ feet astern. The gyroscope is mounted about midship; it weighs about eight tons; and all the attention it requires can be easily given it by the engineer on watch.

A general view of the gyroscope is shown in Fig. 1. Figs. 2 and 3 show front and side elevations and sections. This gyroscope is operated altogether by an electrical motor and apparatus, resulting in very low operating cost. The gyroscope disk or wheel is driven by electric motor *A*, which also serves as a motor brake. The current is taken from the regular ship-lighting generator, which is of sufficient size to furnish the necessary surplus to keep the gyroscope

*President, Hess-Bright Manufacturing Company.

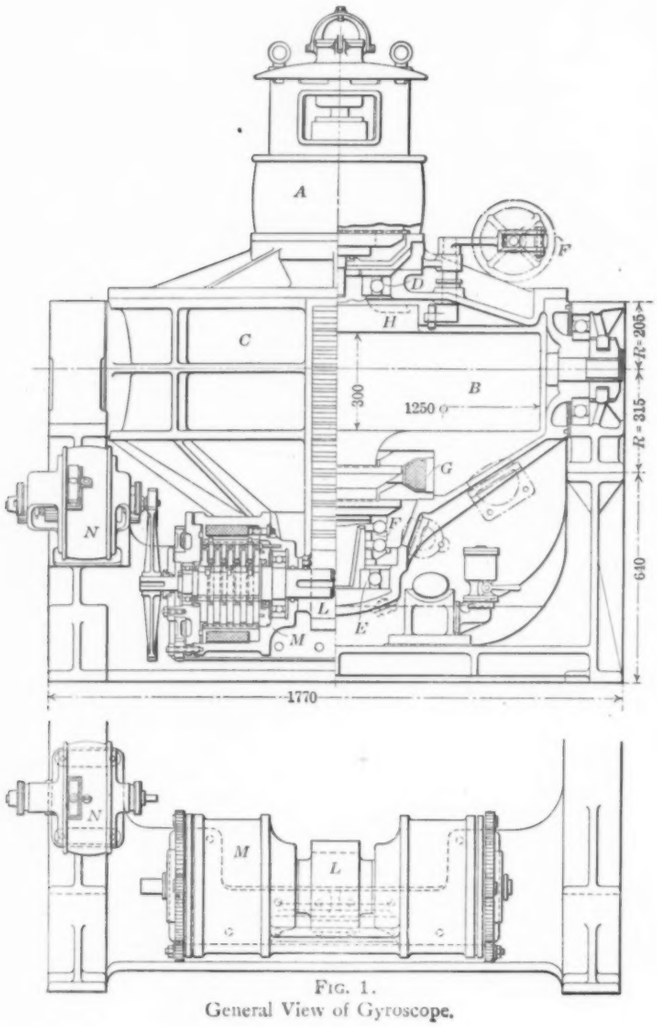
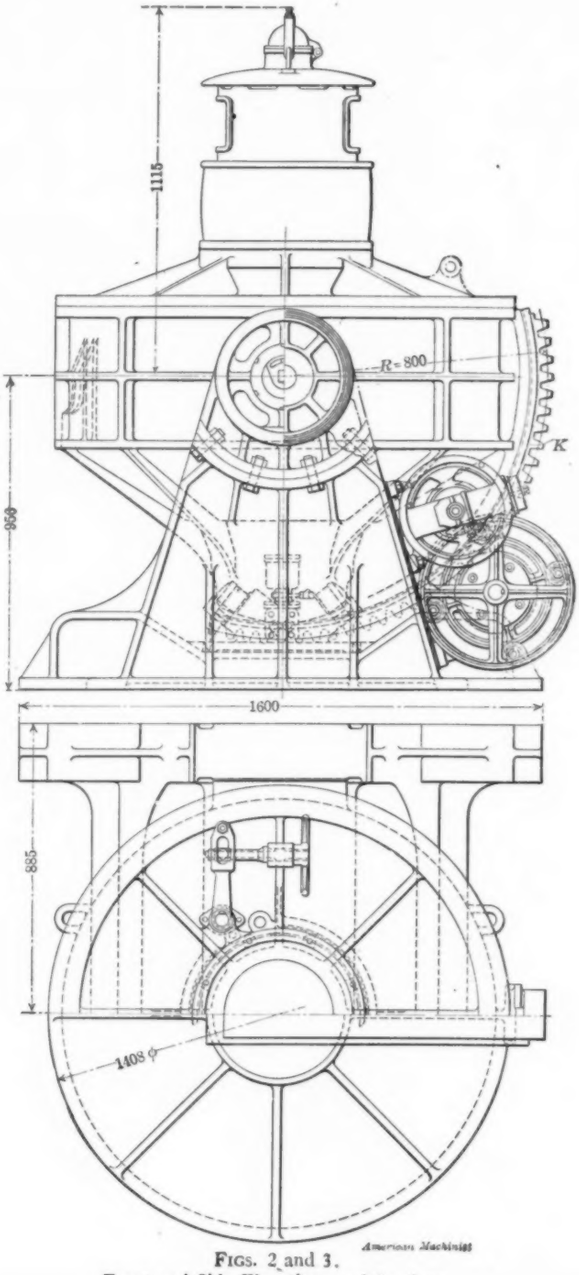


Fig. 1.
General View of Gyroscope.



Figs. 2 and 3.
Front and Side Elevations and Sections.

in motion at its highest speed of 2000 revolutions per minute.

Utility of Ball Bearings

The gyroscopic disk is mounted in an airtight steel casing *C*, the cover of which contains the upper-spindle ball bearing *D*, while the base carries the lower-spindle ball bearing *E* and the thrust ball bearing *F*. These ball bearings have given every satisfaction, notwithstanding that very high pressures are sometimes imposed on them at high speeds..

Since the chief resistance to rotation of the disk is that of journal friction, and as that has been reduced to a minimum by the use of D W F-Hess-Bright ball bearings, the power required was reduced to the small amount of only 4½ horsepower. While getting to full speed rather more than double this power is required for about one hour.

It was originally intended to run the disk in a vacuum in order to save power, but it was found that the saving was too inconsiderable to justify the complication.

In order to energetically brake the gyroscope disk, the motor operates as a generator driven by the disk. In addition a hand-operated brake is provided; this is used after the generator has first reduced the speed.

Roll-damping Mechanism

The gear segment *K* is firmly fastened to the disk housing, which engages the pinion *L*, and through that the main brake proper *M*, which is of the multiple-disk type. Braking pressure between the disks is not due, as is general, merely to levers, screws, etc., but also to electric current, furnished by the small supplemental generator *N*, which derives its motion from the oscillating gyroscope housing.

The various brake disks are made of iron and surrounded by a wire coil. Sending the current through the coil results in a powerful magnetic attraction of the disks and an amount of pressure that could hardly be had as easily by any other means. A return path for the lines of force is provided by incasing the brake disks and coil in a cast-iron housing. Every swing of the gyroscope housing is accompanied by a synchronous rush of current from the small supplementary generator, whose winding receives the current from the primary generator; this results in the magnetization of the brake and a damping of the gyroscope oscillation, fully equal to the action of hydraulic brakes.

Electrically Operated Brake

Not only is this electrically operated brake remarkably simple and certain, but it has the very desirable quality of ready regulation for adaptation to the character of the rolling seas. A change in the field strength of the supplementary generator gives every desired gradation in braking force and regulation to insure a sufficient amplitude of gyroscopic swing and the absorption of a proper amount of energy by the brake.

If, for any reason, it becomes desirable to stop all influence of the gyroscope on the ship, it is only necessary to set up the brake so hard that it cannot be rotated by the gyroscope. This is done by cutting out the current from the supplementary generator and feeding the brake coil directly from the primary generator.

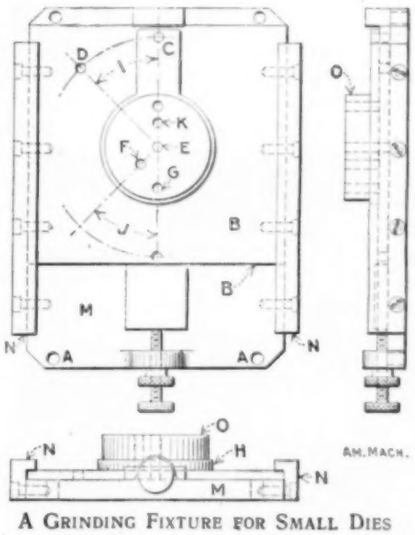
The amplitude of the gyroscopic swing is about 60 degrees, and it is limited by hydraulic buffers of well known type.

The practical result of the application of this gyroscope to the "Schaarhörn" has been the reduction of the amplitude of roll by about two-thirds, or down to about 10 degrees either way. A more energetic action was not required since this ship is used for harbor work, that is necessarily held up in any event, by very bad weather.

A Grinding Fixture for Small Dies

By O. R. Klepper

The fixture shown herewith is so designed that it can be very easily fastened to the faceplate of any lathe in the tool



A Grinding Fixture for Small Dies

room by the use of four small screws, through holes *A* in the base. It will be found especially serviceable where it is desired to grind two or more pieces of any one kind, because then the same master plate *B* is used for all pieces of one kind. The holes in this master plate are very carefully laid off and drilled, and by locating all holes such as *C* and *D* on the same circle, that is, at equal distances from the center *E*, it will be possible to obtain very accurate results.

The distance from *E* to *C* is about four times as great as the distance *E* to *F*; therefore, any error made in the location of holes *C* and *D* will reappear in the hole *F* when being ground, but only one-fourth as great.

To illustrate, let us assume that the hole at *G* has just been ground and the hole at *F* is to be ground next. There is a plug in the hole at *C* which we will now remove and then turn the auxiliary plate *H* so that *C* will be over *D;* then as the angles *I* and *J* are the same, it will be apparent that the hole *F* will now be in line with holes *E* and *G*, and the next thing to do will be to move the slide *B* so that the hole *F* will be where *G* is now, and then clamp the parts in place.

Should one want to grind the hole *K* next, instead of the hole *F*, simply remove the block *L* and push the slide over against the screw and clamp the work down.

Where only one piece is to be ground, there will be no great saving in time, but when there are two or more pieces of the same kind, this fixture will be a great time saver, besides doing high-grade work.

The base *M* with the guides *N* form the permanent part of the fixture, but the plates *B* and *H* are perishable parts and must be made new for each job, while the block *O* represents the die or other object to be ground. *G* is the center of the fixture, and may be trued up by inserting a plug which fits the hole, and then using an indicator on same in the usual manner.

Shop and Other Methods of Distinguishing Various Steels

A professor in charge of the department of mining, engineering and metallurgy of an engineering college was very much surprised one day by the ease with which one of the instructors in the machine shop told the difference between wrought iron, cast iron, low-carbon steel and high-carbon or tool steel. The professor verified the instructor's judgment by chemical analysis, and, finding it correct, returned to be instructed in discriminating between the different metals.

Shortly after, one of the junior students told the machine-shop instructor that the professor had very learnedly been lecturing to them on "the physical properties, characteristic appearance, and molecular structure of cast iron, wrought iron and low-carbon and high-carbon steels."

Nearly 100,000 horsepower is being developed from flowing water in Tennessee, according to a report of the United States Geological Survey. The completion of water projects now under construction in that State will probably more than double the present development.

Useful Machine Shop Trucks

By F. A. Stanley

Several useful trucks for conveying machine parts about the shop and for moving lathes which are already skidded ready for placing in the storage warehouse, will be seen in the accompanying engravings. These trucks were designed and built by the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, and the views represent them as utilized in the shops and warehouse of that company.

Fig. 1 illustrates an electric truck with a trailer which is coupled to the footboard of the truck; or the truck may be used independently, as desired. Both motor truck and trailer are of a size that allows them to be operated conveniently about the shop floor in carrying castings or machine parts from point to point. The body of the motor truck measures inside, 4 feet 9 inches long, 2 feet 7 inches wide and 15 inches deep. The end board works in a slide to facilitate loading and unloading, and if desired the side boards can also be removed.

The truck is operated by a 3½-horsepower motor which is geared to give two truck speeds approximating two miles and three miles per hour. The controlling levers, steering wheel, etc., are plainly shown in the engraving.

Fig. 2 is a view in the new storage warehouse and shows two special trucks built for moving lathes from the shop to the warehouse and for placing them in the desired position in this building. The high truck is provided with two rollers which are carried between supports operated by eccentrics to lift the rollers free from the top of the truck or to drop them again into inoperative position. The lathe is lifted by the crane in the main shop and placed upon the truck which is then employed to convey the machine to the warehouse. The truck is of such hight that when the supporting rolls under the lathe skids are elevated by the eccentric shaft the lathe may be rolled directly off into the elevated portion of the floor. The low truck seen on the floor to the right may then be slipped under the skids for moving the lathe to the required point in the warehouse.

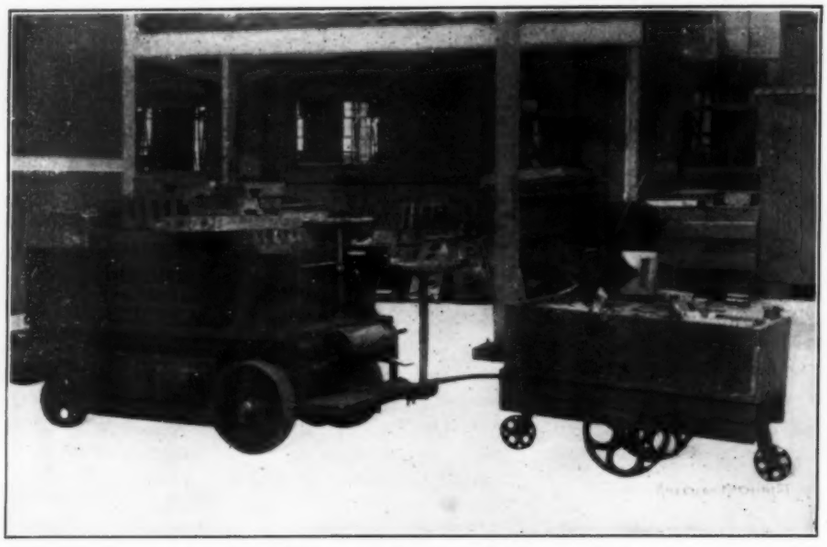


Fig. 1. A Homemade Electric Truck and Trailer

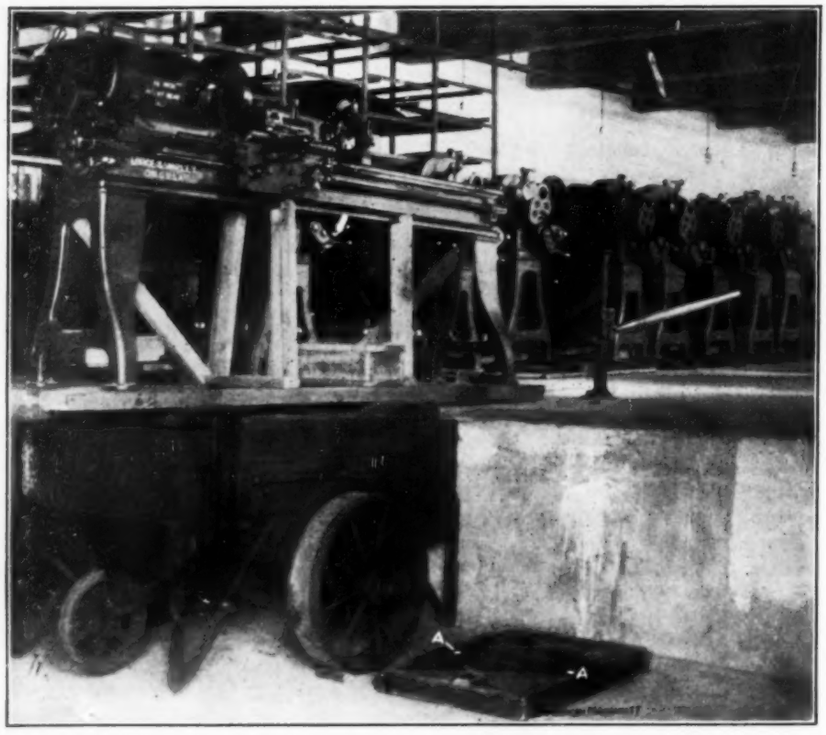


Fig. 2. Two Trucks Used in Storage Warehouse

Fig. 3. Spindle Trucks

The latter truck is a casting not over two inches deep with two wheels in the middle at *A A*, which take the load, while at each end there is a single smaller wheel that prevents the end of the truck, when tilted, from dragging on the floor, though normally the truck does not rest upon either of these wheels while in operation. This truck being so low requires but a slight elevation of the lathe for its admission under the skids.

The trucks in Fig. 3 are for handling lathe spindles in various stages of completion and are fitted up with several pairs of wooden end bars or side bars as the case may be, in which are cut semi-circular notches to receive the spindles. These seats keep the spindles from rolling about and from coming in contact with each other, a feature of growing importance as the work approaches the finished condition. Also, whether placed lengthwise or transversely upon the trucks the spindles are readily picked up without injury to the workman's fingers or to the spindles themselves.

A British View of Shop Efficiency

By J. T. Towlson *

An English foreman's opinion of the effect of limiting initiative and the resulting increased cost of work as seen in the light of over thirty years' experience.

*Shop foreman, Silvertown, London, England.

A few weeks ago I was asked to give, before a board of managers of a large concern, my views on necessary factors of economy in the machine shop. Perhaps an abridgment of these ideas will be of interest to readers of the AMERICAN MACHINIST.

Without question, one of the greatest, if not the most serious, obstacles which confronts a company, in an endeavor to introduce new methods of administration and systems of rewarding labor, is co-operation on the part of the foreman and the men. While admitting this fully, there is no blame attached to these men, for however desirous a foreman may be of carrying out the wishes of his principals, it is quite possible that a system may be thrust upon him so antagonistic to his intelligence that he finds it impossible to fully accept it. A foreman cannot administer a system if he does not fully accept it himself. It is simply judged to be an additional burden and an additional infliction.

SOME OF THE ESSENTIALS

Good management, able foremen, and good workmen, all of the highest class procurable, and all sufficiently well paid so as to command *all* their skill and intelligence; and full appreciation and opportunity for all to give the full benefit of their special skill and experience to the company which employs them: these are the essentials.

Every encouragement, sentimental and financial, should be given to foremen and to men, to instinctively devise and to offer labor-saving devices. Large economies may be effected thereby, even more than is usually considered possible. Such a potent factor of labor saving may frequently be found far less expensive than the buying of new and costly machine tools. Moreover, machine-tool makers do not fully cater to every requirement of special designs of work which come along.

THE SPIRIT OF ECONOMY

The spirit and principle of the closest and most stringent economy should pervade and be permanent in all that comes under the foreman's notice. It is easy to see that, in some things and at particular times, such a spirit is particularly rampant, while at other times it is not so easily discernible.

Persistent, reckless and expensive overtime should be barred and carefully guarded against, rather than it should be, as it is in some concerns, the general rule. The management strives by all known methods, approved and unapproved, after the single units of percentage of economy, during the day time, while it throws away 25 per cent. and 50 per cent., and more, on overtime at night.

It is admitted that at times overtime *must* be worked, but it should for various reasons be the last resource. It applies even to breakdowns, for I know with wise discrimination and with a good plant foreman, repairs could be taken in time, new parts got ready, and even spares could be provided, ere a breakdown occurred. This would be found a far less expensive method than that the shops should be temporarily disabled and other work suffer as a consequence of such a breakdown and no parts ready to replace.

A first-class machine-tool expert should be provided in all machine shops and with a special staff of helpers in large concerns. These should be set apart to continually watch against defects in machine tools, to prepare against breakdowns, and to remedy defects at an early stage and with promptness.

In many shops, nothing is done until a particular machine breaks down. It is then a scramble and rush to get the repair effected, and it is, in consequence, only partly done, the object being to get the machine going again in the shortest possible time, the machine operator in some cases being sent home in the meantime.

MOTIVE POWER AND POWER TRANSMISSION

All shop managers should know that ample and efficiently subdivided motive power must be provided, and there is no doubt that with high-speed steel and the necessary high-power machine tools to suit such steel, many shops require a complete overhauling, to meet the extra burden put upon the means of power and power transmission.

More than passing attention should be given to the securing of efficiency of other details of power transmission. The lineshaft and the countershafts of a machine shop are generally responsible for a greater waste of motive power than we realize.

It is now considered sufficient that ordinary bushes be used for bearing hangers and brackets, whereas greater attention should be given to the claims of experts who with the introduction of ball bearings for lineshafting guarantee to reduce the running costs of machine shops to a very small figure. Is it not true that in many shops and factories this most important factor of the shop equipment is relegated to the charge of a greaser, and to the hands of a rough and incompetent fitter when breakdowns occur?

There is no doubt that this item, the keeping of all the power and transmission gear, should be of the best kind procurable, and at all times in the hands of a first-class plant fitter. Breakdowns should be attended to by efficient preparation and if a little overtime must be worked, let there be a small unit of machines—a lathe, a drill, a miller, a shaper, a planer and a slotter, under one motor, provided for the purpose.

EXPLAINING NEW WORK

In my opinion, the specific object and aim of the designer of new work should be explained to the shop foreman whose duty it is to see such work executed. Generally, and under many systems, when a batch of drawings is sent into the shops, often without a general arrangement, a foreman does not know whether they are details of something which when completed may take the form of one thing or another. We do not generally know what quality of work is required, and often have to work in the dark. This is not economy, and a remedy should and could be easily found, i.e., by the fullest information being given to "the man in the shop" by his office colleagues.

CHECKING THE QUALITY OF CASTINGS

All castings should be carefully checked by an expert, as soon as possible on receipt of same, and none should be sent to the machine shop unless passed by a competent inspector.

Considerable time is lost, with relative cost, and delay results, and promises of delivery are unfulfilled, when the machine-tool operator on starting a job finds that the castings are incorrect and faulty in a way which could easily have previously been discovered and replaced by competent inspection.

All castings should be guaranteed by the founder to be of good machining metal, and on the founder should lie the burden of replacing promptly those too hard to conveniently machine, or in other ways not up to guarantee. I do not know of any reason why the supplier of castings should not make good the cost expended on the machining of castings found faulty on being machined.

Where is the economy in purchasing new machinery, expensive high-speed drills and high-priced steels, with the view of effecting the last point of economy, if we accept without question castings which annul and make noneffective all our efforts in that direction, by increasing the labor cost in such details, from 5 to 100 per cent.?

I would like just here to speak freely on the estimating and instruction department, the "scientific management" department. Must we not advocate a common-sense management in preference to the other, and a set of conditions which embody the best work in the least time, at the lowest cost, and with relatively good wages and salaries to those who produce these results.

From the shop side and from the employer's side I do not think the instruction-card business is good and for this reason: The placing of an autocracy, and instruction dictatorship in the hands of one or more officials, is not good. I cannot accept the principle, even, that one or two mortals, however clever in their own particular sphere, should be invested with an authority to inflict his or their circumscribed methods of executing work upon any number of experienced foremen and men. In a most impersonal, though none the less emphatic, way, I believe that even if the officials of the instruction department be as efficient and proficient men as ever set foot into a works, their training, their previous and present environment and even their daily work lead them into, and keep them in, a comparatively narrow groove. It is particularly absurd to imagine that they can be even the least familiar *with all that is known* of the way to get through the work with economy and efficiency.

What is to be done with the knowledge, the experience and invaluable initiative of the shop men who by virtue of the amount by which they have excelled and do excel the second and third ranks of mechanics have been chosen to fill superior positions? Would not it be passing strange if the aggregate, if not the individual, knowledge of the foremen and his men did not far exceed that of the specialized officials of the instruction department? I am sure, for I have seen it proved time after time, that a system which openly robs the concern which employs us of more than half our production value and tends to convert experienced all-round machinists and mechanics into elements of a cast-iron and inflexible obscurity, is not getting value for its money.

Do we not often see how money could be saved in the shops in various ways, not in pence, but in shillings and in pounds? Do we not know and could we not intuitively devise methods of reducing the cost of work? And would not this be as wise a way of effecting economy as are the methods of the dictators of the instruction department whose stock in trade in the following after a profit seems often to consist in offering low and ridiculous prices for men's labor?

There is one other serious question connected with the instruction-card system and the shops: Not every job in any particular shop is affected by it; i.e., is not more directly subject to it, but is made to suffer in consequence of it. A big job with instruction cards is sent into the shops, and the foreman is told that *"this job has got to pay,"* the inference being that no matter how other jobs may suffer, this particular job has got to be faked and made to show as a paying item of work. The time between the clocking on and the clocking off of the instruction-card details is confined within the very narrowest limits while the ordinary work, repairs, etc., which precede and follow after these favored operations are not so fortunate.

The men for various and obvious reasons endeavor to keep within the time limit and unfavored jobs suffer thereby and at the close of the instruction-card work the cost departments are deceived with the statement of costs, and perhaps are pulled into the idea that the company has made a profit on that particular job. These are facts with which few but shop men are familiar and I suggest that the only remedy is that every job should stand on its own merits and foremen should not be influenced by the inference or command that any particular job has got to be shown to pay, whether it actually has paid or not.

The Weir, the Rown, the Halsey, the Taylor and the Gantt systems all have something in their favor, but all legerdemainic premium bonus plans are subject to juggling. Some are unqualified confessions of inability to set a fair time limit for work; the estimator himself, unable to accomplish the task, relies upon charts and the like.

As a works foreman of thirty years' standing in various parts of the world, I have this to suggest. That system of paying wages is best which guarantees a minimum wage in return for time surrendered, which varies wages to suit different ages, trades, time and character of service; which, in addition to guaranteeing wages, sets up a definite equivalent in work or output for each minute of employment; which enables each man to show his own personal efficiency and rewards him accordingly and which gives both employer and employee an absolutely square deal.

This, I submit, is the standard by which to judge any system of wage reward for work done. Day wages, piece rates, premium systems, only partly fulfil their standard, and each in its way has both good and bad features.

Casting a New Hub in an Old Gear

By F. D. Buffum

Several years ago a repair shop had to increase the bore of a 20-inch diameter 3-inch face cut-steel, half-segment gear, from 2 7/16 inches to 3 15/16 inches, on account of the failure of another part of the shaft it worked on.

The new bore would have left but a shell of the old hub, and the arms were too light for welding to a new steel hub.

It was a 1000-mile trip to the nearest gear cutter and return, to say nothing of the time that would have been needed to forge or cast a new blank, so the old hub was cut out entirely and replaced by casting an iron one of the required size on the old arms.

The new hub had extensions up each arm so that the arms set in deep pockets. The steel casting was sufficiently rough to make the iron grip the arms firmly.

After closing a shrinkage crack, by shrinking 1-inch square, smooth, forged-steel bands on each end of the hub, and boring and keyseating, the result was satisfactory and the cost was only a trifle over $6, while a new wheel would have cost over $30.

American manufacturers and exporters already interested or likely to be interested in the Australian market will find in a handbook just issued by the Bureau of Manufactures, Department of Commerce and Labor, valuable information regarding the resources, industries, and trade of that country. Reports furnished by Henry D. Baker, detailed on special service as vice-consul general at Sydney, comprise the bulk of the book, but these have been supplemented with articles from other consular officers in Australia and with data from statistical publications of the Commonwealth. Australia now purchases $250,000,000 of foreign goods annually, one-half of which comes from the British isles and only about one-tenth from the United States. Copies may be secured upon application.

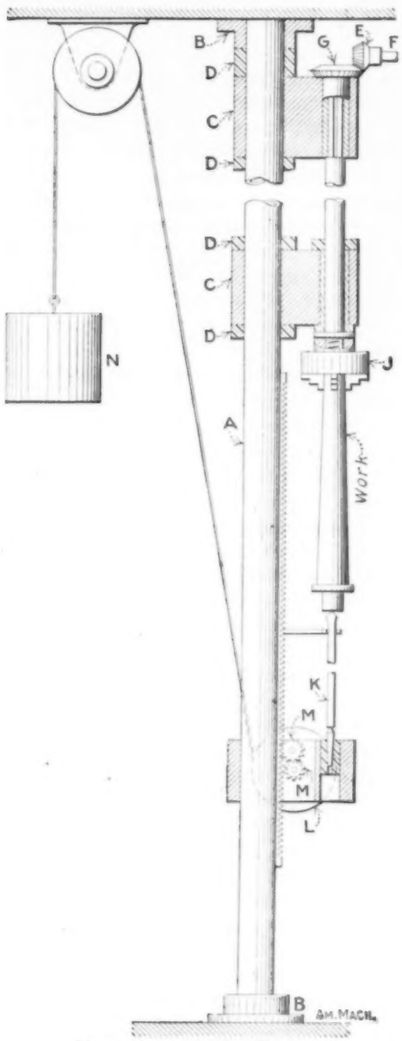
Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Vertical Spindle Driller

The accompanying figure shows a piece of labor-saving mechanism, a machine for rough drilling lathe spindles, in use in the shops of Fay & Scott, Dexter, Me.



VERTICAL-SPINDLE DRILL

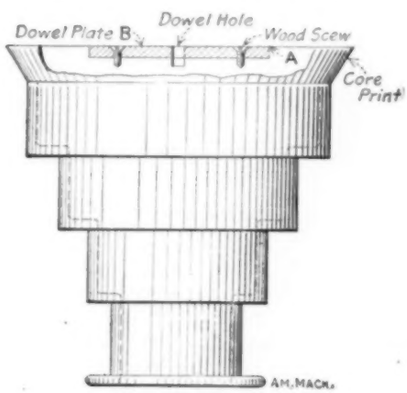
A piece of 6-inch pipe *A* extends from the floor in the lower room to the floor timbers of the upper room, held in position by shoes *B B*; *C C* are cast-iron heads containing the driving mechanism, held in position by collars *D D D D*. *E* is the bevel driving pinion fastened to the end of the countershaft *F*; *G* is the bevel driving gear; *H* is the driving spindle; *J* is a 3-jawed universal chuck to hold the work; *K* is a flat drill.

Power is transmitted to the drill by means of a weight *N*, causing the wire cable to unwind from the drum *L*, and through the gears *M M* and rack. The operator of this machine can keep one or two other machines in operation. As the work is held in a vertical position, the hole is cleaned from chips by gravity.

Dexter, Me. E. W. TATE.

Making a Dowel Hole More Durable

Probably many a pattern-room foreman has had his patience tried sorely when a pattern was returned from the foundry, to find that the molder had used the dowel hole, used for locating some standard core, for a rapping hole.



A DURABLE DOWEL HOLE

Anyone who has anything to do with castings knows that it is very essential that standard stock cores be located properly by the molder. If the molder uses the dowel hole for a rapping hole, it is not a great while before the hole is so enlarged that it is impossible to locate the core print for central core.

It had become a regular occurrence for me to find a pattern in this shape until the following scheme was devised.

The print for the main core was recessed at *A*, in the accompanying figure, to receive a cast-iron plate *B*, which had previously been trued in the machine shop.

The shop standard dowel hole was bored in this plate, and the plate secured to the print by wood screws. Since using this device, we have found it no trouble to make the central core lie in a plane parallel with the hub of the cone pulley.

Dexter, Maine. E. W. T.

Time Lost through Lack of Small Tools

A peculiar fact which I have observed from time to time, is that there is too often a deplorable lack of what are commonly called small tools in machine shops and tool rooms. This condition is not only true of small and poorly equipped shops, but often in those shops which have the finest and most expensive machine tools. It is really ridiculous to see a fine battery of millers, and then find that the tool crib does not contain a single face mill fit to use; or to see a group of good drillers, some of which are fitted with chucks years out of date.

If men only stopped to figure how much time their mechanics lose through the absence or poor condition of counterbores, machine-vise parallels, reamers, drills, taps and the many other small tools that go to make up the equipment of every good shop, they would realize that it would be best to get along without some expensive machine tool and invest the money in some of these things.

Buffalo, N. Y. ARTHUR F. KUNZE.

The New Mechanics

As has been pointed out repeatedly, of late, in France, the contrast between the so called "new mechanics" and the old mechanics based upon Newton's laws of motion offers some interesting features.

The conceptions of the new science of motion are not easily presented to the lay mind, because of their entire novelty. In a word, the modern idea is that a constant force acting upon a moving body does not impart equal velocity in each successive second, but that the accelerative effect decreases as the velocity of the body becomes greater, and finally reaches a limit that it cannot pass. This limit is the velocity of light.

In other words, the inertia of matter increases with its velocity of translation, and becomes infinite when the velocity is equal to that of light. Another form of statement is that the mass of a ma-

terial body increases with its velocity of movement, and that there can be no motion swifter than that of light; that is, about 186,330 miles per second.

EDWIN TARRISSE.

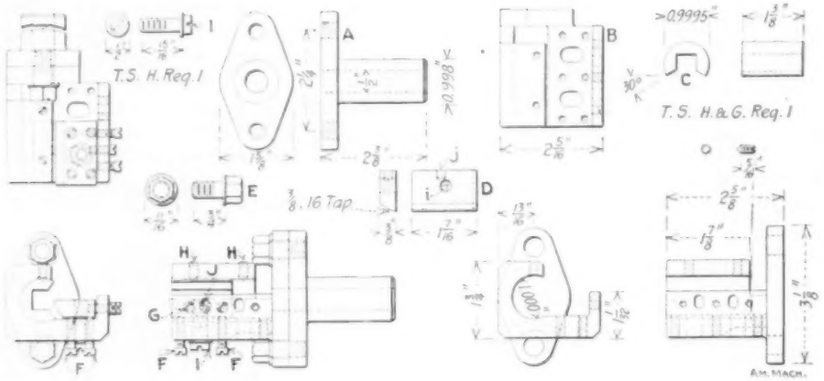
Washington, D. C.

Box Tool for the Automatic Screw Machine

The accompanying illustrations show a form of box tool for the Brown & Sharpe automatic screw machine that leaves very little to be desired. Only the dimensions for the No. 2 machine are shown, but the tools are the same in general principle for the other sizes of machines.

A is the carrier with ½-inch hole through the shank, which is made 0.998 inch, the proper size for the No. 2 machine. *B* is the body, and is held to *A* by the two cap screws *E*. The holes in the body *A* for the screws *E* are 1/16-inch large, to permit centering the body with the spindle of the machine.

C is the stock support or bushing. It is held in place by screws *H*. More



BOX-TOOL DETAILS

than one support can be used, or if desired, a tapered support. The latter is often used for turning tapered work, for which this box tool is very efficient.

D is the cutter and *i* is a tapered hole for binding screw *I*; *j* is a tapped hole for screw *J*, which is used when adjusting to withdraw the cutter from the work. *G G* are screws used to adjust the tool to the work. *F* are screws that are used to adjust cutter or tool to proper hight.

The holes in the body of the tool for screws *I* and *J* must be elongated, as *I* is affected when tool is adjusted for hight and *J* when adjustment for diameter is made.

While the tool shown was made particularly for the Brown & Sharpe machines, the only change necessary to adapt the tool to other machines will be in the shank.

Providence, R. I. D. A. CARR.

Blank Casting to Be Kept in Stock

A mine machine shop, which has to repair on short notice all kinds of machinery, including steam turbines, engines, dynamos, motors, pumps, etc., has for years been in the habit of carrying in stock a supply of round, cast-iron disks 2 inches thick, and ranging by 2-inch steps from 8 inches to 20 inches in diameter, and also 2-inch thick squares of corresponding dimensions.

Some of each size have 1½-inch diameter cored holes through the center, and others are solid. There are also carried in stock 2-inch, 4-inch and 6-inch diameter rounds about 12 inches long, and the corresponding sizes of squares of the same length. Some of each have 1-inch holes cored full length and central, and the others are solid.

The cast iron is soft and is always sound and free from blowholes, and can be rapidly machined to make such parts as pistons, piston rings, cylinder heads, rollers, eccentrics, distance pieces, counterweights, pulleys, bushings, glands, and pipe flanges, as required for emergency repairs.

Frequently disks are riveted together with steel rivets when a greater thickness is required, and, in fact, the variety of shapes that can be readily and quickly worked up from these shapes, singly or combined, is surprising. The time used is much less, as a rule, than would be needed to make a special casting and machine it, even if the molder had the pattern and could start at once. Time is a big item, frequently the biggest, in such repairs, and, if it were not for this stock of blank castings, much money would be tied up in finished spare parts, some of which might be carried for years before being used.

The value of the raw material required to be kept on hand is small, with these blank castings, because the price per pound is low, and they are shipped by freight, at a low rate.

Scottdale, Penn. F. D. B.

The Best Grinder Operator

I claim the best grinder operator is the man you train yourself.

It is generally conceded that a first-class lathe hand can operate any machine, and that when he has become used to the particular machine, he will beat the specialist who has never worked any other type of machine.

But in grinding, the experienced turner can claim only two advantages over the unskilled man. These two advantages are:

First, the knowledge he has acquired that enables him to arrange his work in a sequence of operations most suitable to the work in hand.

Second, his fineness of touch and skill in measuring, which probably have taken him many years to acquire.

These are, no doubt, two great advantages, but if we analyze them, we shall see that they can be greatly discounted. For instance, the best arrangement of the grinding operations can be, and, with unskilled labor, must be made by the foreman who has charge of the grinding section.

The second apparent advantage has been greatly discounted of late years by the general introduction of the micrometer. It has been observed that the semi-skilled hand on the grinder turns off work much nearer to the predetermined size when using micrometers than the skilled man produces with the ordinary caliper and a size taken from a plug, or with the ordinary fixed horseshoe caliper. Experience has demonstrated to me forcibly the truth of this.

The grinder is a special machine and requires a specialist to operate it at its highest efficiency. I believe that operators for it are obtained only by training them from semi-skilled workmen. Young fellows who have had a little experience on the lathe make the very best material, as they are partially equipped in the essentials that go to make for success in operating a grinder. These young fellows will read and will try to understand all the matter on grinding that they can secure, if the person responsible for them encourages them to do this and directs them in the best methods of operating. If the instruction to a young man is thorough, by the time he has become a skilful grinder he also will have become a thorough operator, and can be depended upon to put the work through his hands quickly and correctly.

The more machines there are the less trouble it is to train operators, because when there is plenty of grinding, it can be so arranged that one machine roughs out the work while another one finishes it. Thus, a young operator can be brought along steadily until such time as he can be trusted to do the best work.

W. G. G.

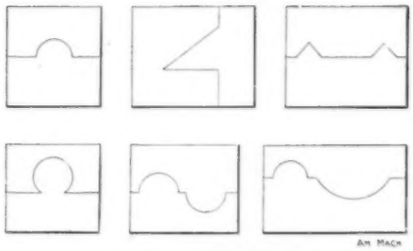
Plumstead, England.

Improvised Templets

In all probability there are many mechanics who have still to make their first acquaintance with the metal called nickel zinc. It was first brought to our notice by an odd-work die sinker bringing into our little machine shop a punch and die forging intended for blanking out hexagon pieces, to be treated on the shaping machine, speed being one of the essential features of the job.

Now, as we had no miller or indexing arrangement, marking out and working to the lines was being resorted to when the odd-work man said he could help us if we had a small sheet of nickel zinc handy. But nobody in the shop had ever seen or heard of such material. However, he quickly dispelled our skepticism by procuring some from a metal warehouse in the same block.

He then proceeded to demonstrate how any form and its counterform could, with the tools usually employed in marking out, be quickly produced. As a matter of fact, with the aid of a straight-edge, dividers and scriber, internal and external templets of complete hexagon shape were ready for use in about 10 minutes.



IMPROVISED TEMPLETS

To explain about the properties of the metal: The form referred to here is, of course, thin rolled sheet, the rolling making it very hard and brittle, so that it quickly crystallizes with slight bending; the surface also is well finished, and comes out quite glossy, which lends itself readily to marking out. Now, if a piece be taken and a line drawn firmly across with a sharp scriber, very little bending is required to cleanly sever right across this line. In like manner, with a pair of good, stiff dividers a circle may be described on a piece of this metal and the disk broken out with very little trouble.

Now, suppose a pair of temporary radius templets are required for a special purpose, marking out is done as in Fig. 1, taking care not to overstep corners where radius joins straight lines. A very little practice only is necessary to be able to break clearly apart without buckling, owing to the rapid crystallization. Some other forms are given in the other figures. While in no way suggesting that there is any permanent use for templets so made, there are occasions when an experiment or trial to obtain an approximate result can be made which, if depending upon the usual drilling, chipping, filing, etc., would have to be abandoned.

B. N. BIRMINGHAM.

West Bromwich, England.

Belt Troubles

There are certain branches of light automatic machinery of the fast-running type, buffing machines, etc., where the designer finds the possibilities of his machine constantly limited by belt difficulties. He is up against such troubles as hard as a prisoner is up against the prison walls. Whichever way he turns they check him.

Sometimes the difficulty is simply that the belt is constantly stretching, owing to its being impossible to get a sufficiently long drive. At other times the spindle, which has to be driven, is itself a moving part of the machine, and in this latter class we often find the most elaborate and grotesque attempts to keep the tension on the belt. Take the most simple case first and refer to Fig. 1. This illustrates a device with which I have overcome many such obstacles. It is here shown for a round belt, but, providing too much slack has not to be taken up, it can also be used for the flat belt.

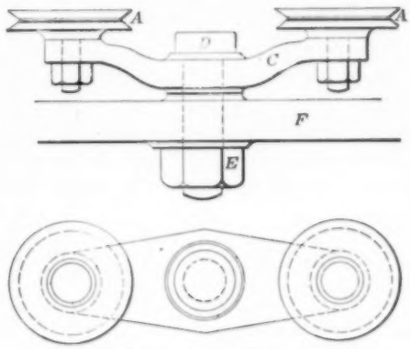


FIG. 1. Device for Tightening Belt.

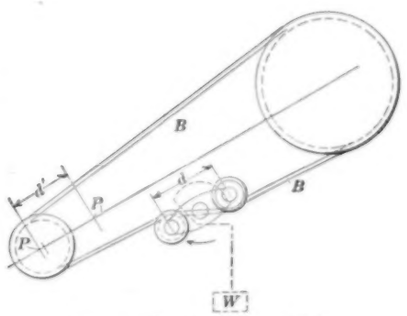


FIG. 2. Showing Run of Belt.

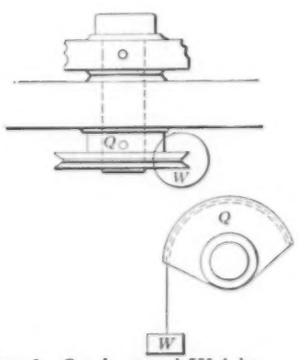


FIG. 3. Quadrant and Weight.

American Machinist

A A are two *V* pulleys running on ball bearings, which are secured to the carrier *C*. This simple contrivance must be attached to the frame *F* in such a position that the straight run of the belt *B*, Fig. 2, will pass over the center of the bolt *D*. By slacking the nut *E* the pulleys may be turned about the center *D* so that they will not interfere with the run of the belt. On the other hand, if it is required to put more tension on the belt, the pulleys can be readjusted in the direction indicated by the arrow, Fig. 2, and the amount of slack taken up to vary with the distance fixed for the center to center of the two pulleys. In any case a slight movement will take up far more slack than a large movement of the ordinary idler.

The application of this device in the case where the driven spindle is being fed backward and forward to its work is shown in Fig. 2.

P P are the two extreme positions occupied by the driven spindle. It is well to make the distance *d* between the centers of the *V* pulleys not less than *d'*, which is the travel of the driven spindle.

If this is done the two *V* pulleys need never be rotated about *D* as far as the position where the line joining their centers becomes at right angles to the natural run of the belt. Thus sharp turns are avoided. In this case the carrier is not locked to the frame as previously described, but is pinned to the spindle and allowed to swivel in the frame, backed by the boss of the quadrant *Q*, Fig. 3. Over this quadrant a wire rope passes, and to this a weight *W* is attached. This causes the carrier to tend to rotate and thus keep a constant tension on the belt, whatever may be the position of the driven spindle.

Whiteinch, Glasgow. P. BALLARD.

Tools for Enlarging Bore of Emery Wheels

A very successful tool for enlarging the bore of emery wheels can be made by mounting a set of emery-dresser burs, so that they are free to revolve, on the turned end of a piece of rectangular steel placed in the tool post of a lathe.

Cut the lead out of the emery-wheel bore, place in the lathe chuck, and true up; then let it rapidly revolve, while the burs are fed back and forth through the hole, until it is cut to the desired size.

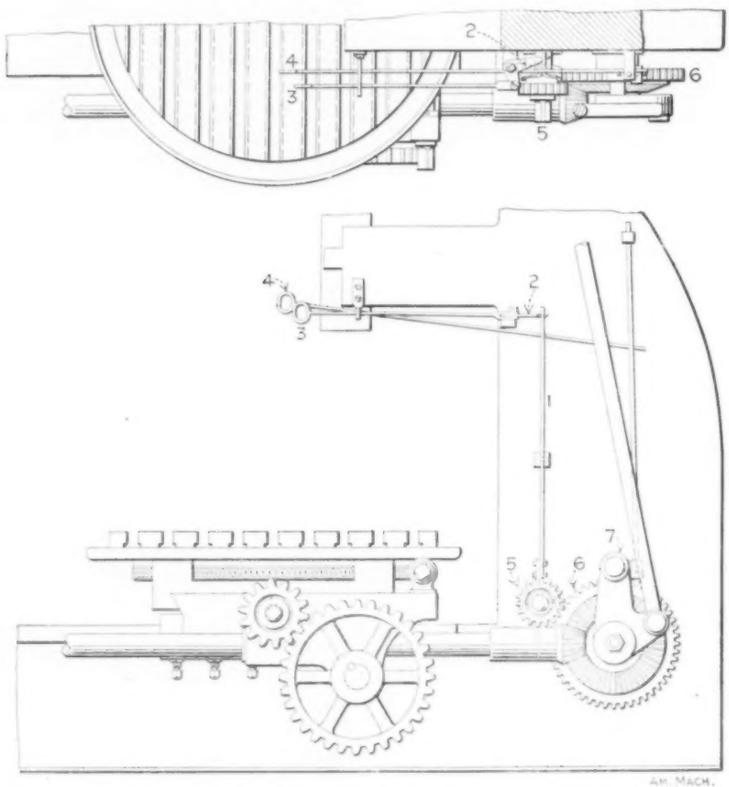
Indianapolis, Ind. W. M. BARNES.

Two Shift Levers for a Slotter

One of our machinists, W. Shaw, at the Chicago & Northwestern Railway shops, has put two levers on the slotter that save a lot of time, as the operator no longer has to climb over his work or go around, to shift his cross feed.

The cut is very plain and shows that lever 3 throws gear 5 in or out of mesh with gear 6, and lever 4 raises and lowers dog 7 which throws the feed in or out as wanted.

Before these levers were put on, the operator had to go over and shut off the power feed some time before the job was finished and then go back and feed by hand, which, of course, was lost time, but now the power feed is left on until very close to the line or size, when it is easily thrown off by the levers shown.



TWO SHIFT LEVERS FOR A SLOTTER

CHAS. MARKEL,
Clinton, Iowa. Shop Foreman.

Winding Springs

Catch a piece of stock the size required in a lathe chuck with the wire under one jaw. Pull the belt round while holding the wire and form a couple of turns the pitch wanted. Then take a patternmakers' wood clamp and seize the coils formed between the jaws. Tighten up and the wire forms shallow grooves in the jaws. See that the wire is clear of snarls or kinks. Start up and see your spring forming. When coming to the end cut the wire before you take off the clamp and stand clear. You do not have to pull the belt round to allow the spring to slack up. It will take care of itself.

I have wound springs 1½ inches diameter 6 feet long out of 3/16-inch wire, and lathe running on first open speed.

Detroit, Mich. J. C. PARRY.

Night Schools for Machinists?

After reading all the discussions and articles from time to time on the training of apprentices, I think it is timely to consider the training of the man who has passed the apprentice stage. There are a great many machinists who would like to advance further in different lines from those at which they are working. Many of them would make good toolmakers, for which there is ever an increasing demand. Also, many machine operators would make good machinists if they had the opportunity of learning. If there were only trade schools for them, these men would willingly pay for such schools and would devote their evenings to the work and study to qualify. The correspondence schools are good as far as they go, but it seems to me that we need schools for the mechanic where he can learn the higher branches of his trade. Also, some of the theoretical and technical side would be a good thing, especially in the large machine centers.

I should like to hear some of your readers' views on this.

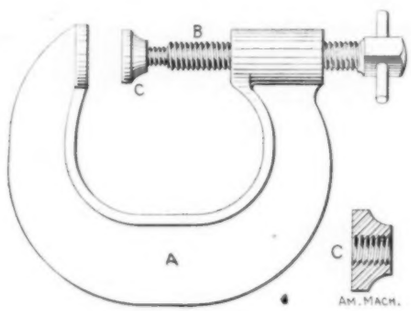
Sunbury, Penn. JOS. A. HAIGH.

A Powerful Clamp

The strength of a coarse thread and its quick adjustment can be had with all the power of an extremely fine one.

A represents the body of a clamp, and *B* the screw. The upper part of this screw is threaded to fit the clamp body. In the lower part, a short section is cut with a finer thread than the upper part. *C* is a nut made to fit the lower part of the clamp screw.

The clamp acts as follows: It will close up quickly until it strikes the work; then when the pressure begins to increase, the screw will recede into the nut somewhat, but not so fast as it comes out at the top. The travel of the nut per revolution will equal the difference in the pitch of the two screws. Thus, if the upper part was threaded 3/16 inch and the lower part ¼ inch, the nut would advance at the rate of 0.0625 — 0.05 = 0.0125 inch or an eightieth part of an inch for each revolution of the handle. In other words, it would have all the power of a clamp with a screw pitch of 80 threads per inch. This is particularly useful for small toolmakers' clamps, where great power with just the thumb and finger is desired.



A POWERFUL CLAMP

Hamilton, Ont. W. HUTCHINSON.

The following mixture, according to the *Brass World*, has been found exceptionally satisfactory for all-round work in the making of sand castings of aluminum: Aluminum, 92 per cent.; copper, 8 per cent., or 92 and 5 pounds, respectively. This mixture casts exceptionally well, does not crack in the mold or crystallize in service and is fully strong enough for the majority of work for which aluminum castings are used. It should be borne in mind that aluminum is a weak metal and, in addition, sand castings can never be employed in engineering work with the same degree of certainty as steel forgings. The difference in tensile strength between the aforesaid aluminum and copper alloy and those containing zinc is but little.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

The Necessity of a Second Annealing

On page 881, Volume 34, C. U. Scott has very ably discussed the annealing question, and while the writer has a very high regard for Mr. Scott's opinion, he would take exception to one point, namely, the necessity of a second annealing of parts that must undergo machining operations.

This point cannot be too strongly emphasized, especially when the parts to be machined are of high-carbon steel and must pass through a final heat treatment of hardening and tempering.

The extra time and expense incurred by this final annealing will, in most cases, be more than offset by the saving in warped and broken parts, and in the cost of final machining or grinding.

It makes no difference how thoroughly a piece of steel has been annealed; if it is afterward subjected to blows, or put under stress from other mechanical operations, strains are set up that will cause warping or cracking of the piece when it is finally heated and quenched.

If a piece of steel has been thoroughly annealed to start with and then the machining done very carefully with light cuts, no great strain will be set up and the final change will be slight—but modern practice calls for high speed and heavy cuts.

Another point is this: So called annealed stock is in too many cases only partly annealed, and when the manufacturer undertakes to treat it as thoroughly annealed, he has trouble on his hands.

Perhaps a few practical illustrations will aid in convincing some of the more skeptical: It was necessary to replace three shafts with hardened pinions, as shown in Fig. 1. A little inquiry brought to light a few facts regarding the action of the steel used in the first set, and started the operator on a little line of investigation.

The steel to be used for the second set of shafts was cut from the same annealed bar from which the first set was made. The steel in this bar had the reputation of being very difficult to harden. A few disks were sawed off and used as checks in obtaining the proper hardening heat. The shafts were cut off, centered, rough turned to within 3/32 inch of size, and then lime annealed, with the result that one shaft showed out about 0.035 inch, and the other two a slightly less amount. They were recentered and finish turned on the portion for the pinion, and about 0.015 inch left on the bearing ends for grinding. The pinions were cut and the pieces hardened and drawn. After cleaning out the centers they were indicated up between centers, and one shaft showed out 0.001 inch, while the other two caused but a very slight movement of the indicator needle.

FIG. 1. STEEL SHAFT WITH HARDENED PINION

This, in comparison with the first set that had been turned and hardened without annealing and showed out nearly 1/32 inch, had to be recentered, and then did not stand up to the severe duties imposed upon them, while the second set wore out a set of phosphor-bronze bushings and were then in practically perfect condition, the pinions showing practically no wear at all.

Fig. 2 shows another case where the design was as much to be criticized as the steel. The reader will observe that the web is on one side of the rim instead of central with it, which gives a chance for unequal contraction and caused a bulging of the web at the center. These wheels had to run at very high speed, and were subjected to unusually severe service, so that it was necessary to have the rim almost full hard, though it was desirable to have the web soft. As before stated, a great deal of trouble had been experienced in getting these pieces to harden without warping, and a good many were lost from cracking.

The practice had been to harden all over and then bring a gas flame in contact with the web and draw it as low as possible without softening the rim.

The second method was to rough turn and anneal, then finish and harden between ⅜-inch plates bolted to each side of the web and extending out as far as the inner edge of the rim. In quenching, the wheels were held in a tank of water, and as soon as the hand could be held against the plate for a few seconds the piece was transferred to a tank of oil and cooled sufficiently to permit handling. The plates were then removed, the rim polished and drawn by rotating in a gas flame until the proper color showed, when it was again placed in oil to remove most of the heat, and then allowed to cool in the open air.

This last method showed but a very slight bulging of the web, and but one piece was lost by cracking, and that one was allowed to lie over night before drawing, and broke into several pieces some time during the night.

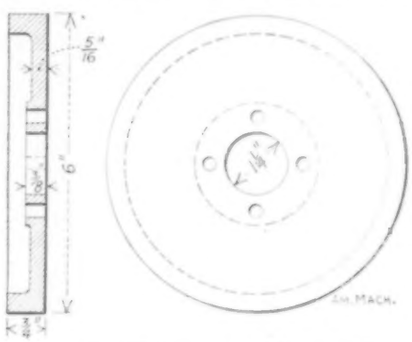


FIG. 2. WHEEL TO BE HARDENED

Poplar Bluff, Mo. M. E. HOAG.

Cylinder Boring Tools

In referring to the article on "Cylinder Boring Tools," page 1082, Volume 34, the method described of peening, adopted for tightening reamer blades, cannot merit much approval. Such treatment disfigures the tool and also reduces the surface contact of the side of the blade in the slot.

To surmount these objectionable features, I designed and introduced a series of rollers for tightening reamer blades; these have justified their adoption. The rollers in this case are 2 inches in diameter, ½ inch thick, and ⅞-inch hole. The periphery is circular, and the radius of it is greater than that of the groove in the reamer body, to allow the roller to act on the outside corners of the groove, thereby causing the metal to be pressed up on the high side of the reamer blade. The radius of each roller is made to suit

a group of reamers, hence the plurality.

In application, the roller is held on a plain miller arbor, in the same manner as a cutter, but not tightened up, the washers simply holding it in position. The reamer to be rolled is placed on a service arbor, and held between the centers.

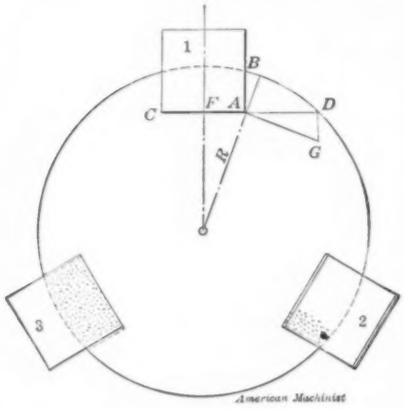
No power motion is required. The reamer groove is brought in contact with the roller, which rotates on the arbor, through the pressure and movement of the table, back and forth. This method gives a highly satisfactory job; blades perfectly tight, and pleasant to look upon.

ANDREW WEBSTER.

Glasgow, Scotland.

Total Keyway Depth

Referring to the article, "Total Keyway Depth," on page 195, I wish to ask why not measure the keyway depths at the sides? The sides are the business part of the keyway, while the hight of the arc, above the line, across the corners, as shown in the line cut, has nothing to do with the performance of the key. As for the shop, consulting a table and then



TOTAL KEYWAY DEPTH

adding or subtracting an odd number of thousandths from such values as ½ inch or ¾ inch, etc., may be good exercise in arithmetic, but it also helps the machinist to make mistakes.

Where the maximum of resistance is wanted, the key should bear on all four sides, and consequently fill the hole completely.

The illustration shows a square key, the side of which is one-fourth of the shaft diameter, bearing on all sides. Let *A G*, drawn left to right, represent the acting force, then for those elements of the key along *A F* and *A B* that are very near *A*, the proportion of stress is as *D G*: *A D*, or very near as 1: 3. Along *A B* from *A* to *B* the resistance increases slightly and along *A F* from *A* to *F*, the resistance decreases to nothing. Out of this follows that the total resistance of the bottom of the key amounts to about $\frac{1}{3} \div 2 = \frac{1}{6}$ of the total resistance of the side. This is something, but not all.

A little clearance on top and bottom of key would allow the metal to *flow* into that space, as shown at 2; the dotted part of the cross-section showing the area that had to be disturbed to make it a loose key. Key 3 shows the condition when there is no clearance, and there the whole cross-section would have to be disturbed and shearing would take place.

High Bridge, N. J. J. SCHURING.

Calculating Angles for Spiral Gearing

On page 1204, Volume 34, there appears an article by E. J. Kearney, on 45-degree spiral gearing. In the first place, I think Mr. Kearney is in error in assuming that from 75 per cent. to 90 per cent. of spiral gears are of 45-degree angle; certainly in my own practice, the reverse is the case, for it is but seldom that I am able to use 45 degrees, or perhaps I might better say that it is but seldom that I find this angle is best for conditions at hand. This, however, has but little to do with the object of this letter.

The table accompanying Mr. Kearney's article is carefully worked out for the use of standard pitches. The result of this is that the center distance of the gears will almost always be fractional. I find that practical gear men are able to cut spiral gears with the ordinary stock cutters, no matter what the pitch is, and it is far better to use a fractional pitch and make the center distance come integral or in common aliquot parts of an inch. For instance, the example that Mr. Kearney works out is a center distance of 3.606, for 10-pitch gears. In practice it would be much better to make this center distance 3½ and let the pitch of cutter come a little smaller than 10. I am sure the advantages of having center distances come in some of the ordinary parts of an inch will be apparent, and the error resulting from the fractional pitch is negligible and cannot be detected in the running of the gears. I have before me, taken at random from past jobs, a pair of spiral gears, 45-degree angle, with a center distance of 4 inches and pitch 8.1304. How much better it is to make this center distance come standard and let the pitch vary slightly from 8. I think also that Mr. Kearney is in error in assuming that the 45-degree angle is more easily calculated than any other angle, because the method of calculation is the same in any case, and if one is able to calculate 45-degree angles, he can readily work out any other angle. If he is dependent on the table for his 45-degree angle, then he is at sea anyhow and can never feel sure of results.

Providence, R. I. FRANK E. WILDER.

Bearing Materials and Cast Iron Bushings

The readers of the AMERICAN MACHINIST have certainly had a treat in the article by Professor Sweet on bearing materials, and also in the answers that have come from various other people on the same subject, notably R. K. Le Blond's article on page 537, Volume 34. This is certainly a very interesting article, from a man who has evidently personally investigated the matter, and gives valuable information. To uphold Mr. Le Blond's statement about the wearing powers of babbitt, I would say that one of my first positions was with a large builder of power presses, headers, threaders and such machinery in Connecticut, and this company used babbitt for its bearings. It seems to me that while lathe work is a more or less even load, press and header work is an uneven load with constant shocks; therefore, if babbitt had not been the best material for their line of work, I am sure that they would have used something else.

Not long ago I did part of the designing on a machine for rolling type, and the superintendent said that he wanted cast-iron bushings, in place of bronze, as they would wear much better. I was somewhat surprised, as I had never heard of cast-iron bushings, but after the machine was built it was found that the bearings stood better than some other parts of the machine.

I have a few questions to ask about bearing materials. The first is: What kind of results could be obtained by using cast-iron bushings in connecting rods on high-speed gas engines, where there is a high compression in the cylinder and rapid explosion? Second: What results could be obtained by using soft-steel spindles and hardening the bushings? Third: What results could be obtained with hardened spindle and soft bushings? In the last two cases the spindles to run at high speed, as in grinders, and in the last case the soft spindles to be carbonized.

I am sure the readers of AMERICAN MACHINIST would welcome more interesting articles on bearing materials. I would like to hear from some of the former contributors on the questions I have asked.

Bristol, Conn. WALTER CLARKE.

A massive iron pillar, nearly 60 feet in length and weighing about 19 tons, stands on the plains of Delhi, in India. This ancient column, according to the *Engineering Magazine*, is literally a monument to the antiquated process and metallurgists that produced it. For it has resisted the attack of the elements during a period of about 2900 years in which fully a million times its bulk of iron or steel has crumbled into useless dust.

The Imported Tool Steel Swindle

By Archibald J. Wolfe*

An old faking game operated under various disguises that make necessary extreme care in placing orders for foreign tool steel with others than known representatives of reputable concerns.

*Chief of Credits' Bureau, National Association of Manufacturers.

Publicity is conceded to be one of the most efficient weapons for combating fraud, yet it seems to fail at times. Strangers still come to New York and are caught by wire-tapping schemes. Guileless Southerners engage in games of poker for large sums with affable chance acquaintances picked up in the hotel bar room. Gold bricks are still being manufactured. The green-goods game is with us yet. The Spanish prisoner swindle is flourishing, although probably every newspaper in this and other lands has described this palpable fraud a dozen times or more. Still people are found who have never heard of it, and are gullible enough to be caught.

Cupidity or stupidity, or both, account in the overwhelming majority of cases for the victims of such gross deception as above referred to. But what accounts for the fact that wideawake business men and manufacturers are such easy victims of the famous Alsatian and French tool-steel swindle? Not only in the United States, but throughout Great Britain and Germany, this nefarious scheme has been exploited for many years. The names of the perpetrators vary, and, of course, they never catch the same fish twice. But hundreds of users of tool steel have been victimized in all of these countries, and for all I know they are at this moment playing the same game, for I have heard of the consummation of such a sale only a short week ago in Maryland.

The Usual Method of Victimizing

There are generally two brothers, one the salesman and the other the office manager in New York, although one of them is, as a rule, said to be on the way to Europe. The salesman calls on a machinery manufacturer; he is a fluent talker, and impresses the victim with the excellent quality of his tool steel. It is offered by some concern in Alsace or France, which usually has an indefinite general name, frequently English in style: The Cosmopolitan, or the Universal, or the United something or other. The sample is excellent. The salesman is passed on to the superintendent or some other employee, and, amid a Niagara of interesting conversation and rapid-fire talk, the salesman lands a small trial order. It is always the salesman who writes out the order and the employee signs. Presently the steel arrives. It is generally found to be in excess of the amount ordered as a trial. Perhaps 20 to 200 times the quantity ordered. Frequently the buyer could not use up the amount of steel received in 10 years. Worse than this, it is the cheapest of mild steel, absolutely useless for the purpose wanted.

Lengthy correspondence ensues with varying results. The buyer generally settles and writes down his loss to an item on his books which might be called "Experience." A humiliating lesson has been learned that the wily foreigner caught a perfectly astute businessman. He tries to forget it. He does not rush into print and tell the trade press about it. It is a poor advertisement of business ability or system, and the defrauders bank on this.

Or the buyer shows fight. He is indignant. But he does not care for litigation, although, if it came to trial, hundreds of instances might be shown in court proving a regular system of fraud. (I am not enough of a lawyer to state whether or not such evidence is admissible. It ought to be considered very weighty by the United States Post Office authorities, however, and the privilege of the mails should be withdrawn from these rascals.) But the thieves are equally anxious to avoid litigation, and they generously agree to settle; they will settle for as low a figure as the buyer has nerve enough to insist on as a minimum.

I have heard of cases where the "adjuster" of these fakers has called at the office of his victims to "adjust" differences, and the buyer has taken some slight satisfaction in kicking him out bodily. It must be admitted that there is a degree of personal satisfaction in this. But such punishment does not stop the career of the tool-steel swindler. He is out for fresh conquests.

It may seem remarkable that the ability, cunning and persistence of these people have not been devoted to legitimate business. With less effort they could secure a lucrative and permanent trade. But that fatal perverseness which accounts for most of the criminals seems to impel them to persist in a career of fraud, and their continued impunity has encouraged and emboldened them.

Sometimes they convey by inference the impression that they are selling the steel of "——— Iron and Steel Company," but that another firm would deliver the order.

Two Cases That Reached the Courts

In England the Alsatian tool swindle dates from 1899. Some cases have been taken to court, with the result that the buyers were permitted to settle on the basis of a mere fraction of the amounts demanded by the swindlers, namely, for the actual value of the steel ordered or received.

On June 30, 1911, an action came into court at Ballymena (Ireland) Quarter sessions, when two men trading as "—— Metal Syndicate," in Alsace, sued David Chrystie, of Braidwater Foundry, Ballymena, to recover £14 8s. 10d. ($70) for goods sold. The proceedings were brief and curious, says *The Ironmonger* (London). The judge asked if the costs had been lodged in court. The plaintiff's attorney replied: "No, but I think that the delivery of the goods is admitted and there is a setoff." The defendant's attorney refused to admit anything. The case was dismissed because the attorney for the tool-steel artists had not been instructed to lodge costs. Rather than go to court, these gentlemen frequently have been known to accept a very small percentage of the claims.

The *Ironmonger* also describes a remarkable transaction between a firm in Colmar, Alsace, and A. A. James, a private gentleman in Rugby. The representative of the Alsatian firm called on him with a sample of metal for making horseshoes. Mr. James informed him that he did not do his own shoeing, but referred him to the firm whom he employed for that purpose. Finally, the agent informed him that the firm in Alsace also made excellent files and chisels, which his employees would find very useful, and which would cost only a few shillings. Steel bars, affirms Mr. James, were never even mentioned. The representative wrote out the order and Mr. James signed. He later received an invoice for almost $600 worth of chisel-steel bars. Of course, he refused to accept the goods. After lengthy correspondence the sellers offered various compromises. In the meanwhile the Alsatians instituted proceedings. The goods had been lying at the station. In the end they accepted £8 14s., or a little less than $45, having in the beginning of the controversy refused to accept £12 ($60).

A Few Words of Warning

The cumulative evidence of intent to deceive and the large number of manufacturers who have been victimized are sufficient warranty to sound a warning. Every agent offering foreign tool steel should name the firm which he represents without any equivocation. If the concern is new to the manufacturer, references of American firms to whom sat-

isfactory shipments had been made in the past should be absolutely insisted upon, and these should be consulted before any order is given. Great care should be exercised in examining the order as written down before any employee of the buyer affixes the signature of the firm. Those who have been caught should lay before their attorneys such evidence of fraud as they may have and seek by consulting the trade press the assistance of fellow victims; but do not pay out a cent beyond the amount fairly due. Above all, no shipments in excess of the quantity ordered should be accepted under any consideration. The victims should also swallow their pride and, by publicity, help smoke out the culprits. There should be no room in the machinery trade of this country for these parasites of industry. And it might be well if all readers of this article who have had similar experiences undertook to collate them, for, as suggested above, they might make it possible for the Post Office authorities to deal with the crooks, besides providing a mighty interesting reading on one of the most ingenious, persistent and nefarious schemes practised on the trade.

A Special Machine for Drilling and Broaching

Fig. 1 shows a recoil valve and above it a recoil-valve casing for 4.7-inch howitzers, which are being built by the Detrick & Harvey Machine Company, Baltimore, Md. The recoil of the gun is taken care of by oil flowing through the ports in the valve and casing. The valves are about 4 1/16 inches in diameter, 7/32 inch thick in the wall and 55.494 ± 0.002 inch.

Fig. 2 shows the special machine for drilling and broaching the ports. Each valve has 1382 holes, 0.140 inch in diameter, drilled through the wall. Where the rectangular ports are broached the holes are drilled as close as possible. The driller at the back is of the friction type. The drill is supported close to the work by a bushing.

The work is mounted on the index centers *B*, the index flange being drilled to receive the index pin *H*. Behind the flange is a worm gear and worm operated by the handwheel *C* when it becomes necessary to shift to the next row of holes in circular spacing. For longitudinal spacing a precision screw *G*, cut by Brown & Sharpe, is used. The carriage *C* carries the driller and its motor at the back and on the front is mounted the turret *I*. Secured in the holes in the turret are the broaching tools *D*. The broaching is done by hand, the pilot wheel *E* giving plenty of power.

To drill the 1382 0.140-inch holes takes a man and a helper about 35 hours. As a check when spacing the longitudinal rows of holes a series of thin flat steel templets were used, one drilled for each row, as all the rows were differently spaced. These were merely used as a check on the helper, who operated the longitudinal dividing wheel *F*.

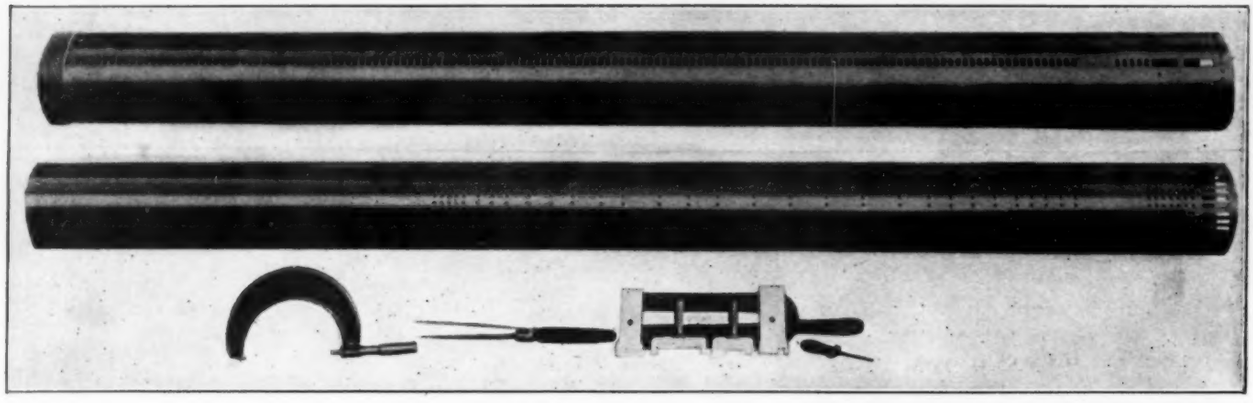


FIG. 1. THE WORK AND THE GAGES

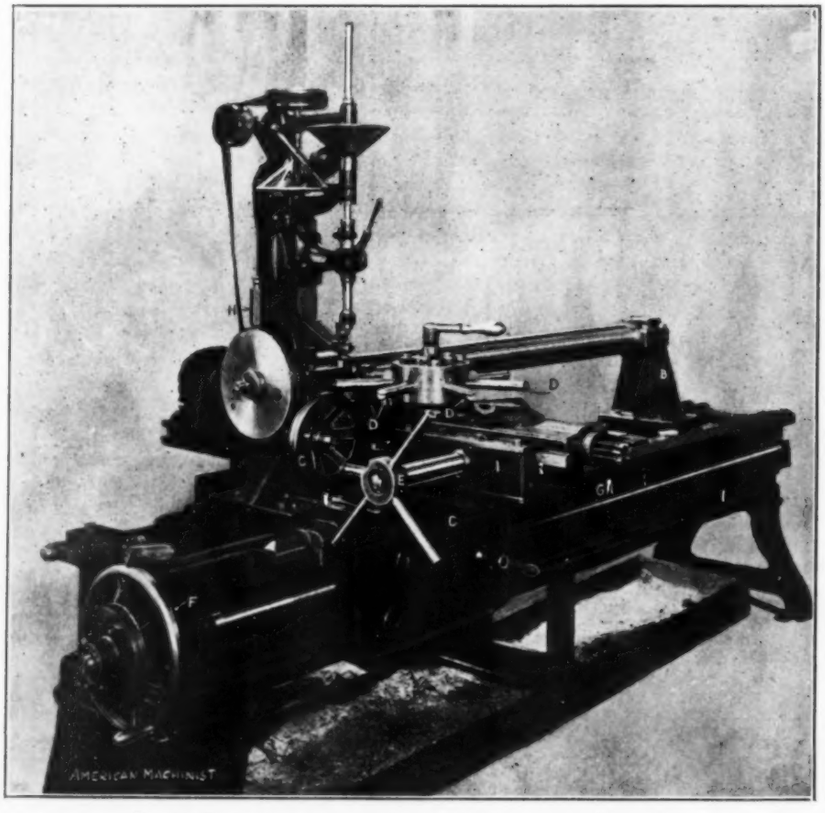


FIG. 2. THE SPECIAL DRILLER AND BROACHING MACHINE

To determine the speed at which you are traveling in a railroad train, count the number of rail joints passed in 20½ seconds. This is equivalent to the miles per hour speed when the rails are the usual standard length of 30 feet. A good way to count the joints is to watch the passing of the "fish plates" on the next track, which is easy to do by looking just past the window edge without trying to focus the eyes on each joint.

How Suggestion Systems Work Out

By H. F. J. Porter*

A refutation of the charge of failure, showing the success both in dollars and good will which has been obtained in many cases. Reasons for its abandonment in a few instances.

*Industrial engineer, New York City.

To the editorial of the AMERICAN MACHINIST a few years back, in which the statement was made that the suggestion system where tried had been found wanting, I expressed the opinion that my experience led me to believe that wherever there had been failure, it had been due to the manner in which the system had been installed and operated, and not because of any inherent defects in the system itself. Statements from time to time appearing in the technical press since then to the effect that the suggestion system has been discredited and practically abandoned still left me unconvinced.

A few months ago, having been called upon to outline the method for the proper installation of the suggestion system in a large industrial plant in Pittsburg, I determined to investigate the subject and to find out definitely how far the assumptions of those not agreeing with me were substantiated by facts, and how nearly my own views and my own experience were borne out by the experience of others. Accordingly I addressed a series of questions to some fifty organizations in this country and abroad, in which I understood that the suggestion system at one time or another had been installed. The list of questions was as follows:

(1) Who collects the suggestions?

(2) Who passes on them?

(3) How much is paid for those adopted?

(4) When is payment made?

(5) How many employees use the system?

(6) How many suggestions are received per 100 employees per month?

(7) What percentage of these are adopted?

(8) Do you feel that the system has operated advantageously in improving:
- (a) The conditions about the place?
- (b) The processes of manufacture?
- (c) The product?
- (d) Business methods?
- (f) The relations between employer and employee?

(9) Have you any committees, of which employees are members, taking part in the handling of this system or of your business otherwise?

(10) What are they?

(11) Is their work satisfactory?

(12) What is the character of your business?

(13) Have you any remarks to make regarding the working of this system outside of those called for by my questions?

(14) If you have discontinued the system, why?

(15) How long was it in service?

(16) Please give me the names of any other concerns who have established this system.

Analyzing the Returns

Now let us analyze the returns and see what is the testimony which they bear upon the merits of the matter.

Seven concerns did not reply at all, four stated that although they believed in the system they had never themselves installed it, and in three cases installation was so recent as to preclude a report of conclusions. Out of the 34 remaining, nine have discontinued the particular form of suggestion system they had been operating, while 25 have used the system with success over periods ranging from one year—in a few instances to 10 years.

Examination of these 25 cases shows the following facts:

Hardly with a single exception, suggestions are collected by a clerk from the office. In eight cases suggestions are passed upon by a committee of employees, by a committee of employers in seven cases, and in the remaining 10 cases by the manager, the superintendent or some other officer.

The usual practice is to pay one dollar upon the adoption of a suggestion, and to distribute monthly or quarterly prizes ranging from five dollars to one hundred dollars to the employee making the best or the greatest number of suggestions adopted. In a few cases the actual value of the suggestion to the business is determined as near as may be, and this is paid by way of reward.

In this group of 25 now being considered, in each of six establishments, 5000 employees use the system; in three cases the numbers run from 3000 to 4000; in three others from 1000 to 2500; and in 10 cases the employees using the system number from 100 to 500. And the number of suggestions received per month per 100 employees varies as widely as the number of employees themselves. From one suggestion per month per 100 employees in seven cases, to 25, 30 and 40 per 100 employees in three other cases is the record. As to the percentage of the submitted suggestions which are adopted, three organizations show 50 per cent. of adoptions, six show 25 per cent., and the majority of the remainder report from 10 to 20 per cent. of adoptions.

Only three of these employers state that they do not feel that the system has operated advantageously in improving conditions, processes, relations between employer and employed, etc., and it is noticeable that in each of these instances the employees have not been given any active part in installing or working out the system, and that they are not represented upon any committee passing upon the suggestions submitted.

Why It Was Given Up

Turning now to the nine cases where the system has been given up, it is not difficult to find why means which have produced satisfactory results in the other places have here spelled failure. It will be best to quote the views of the responsible heads of these firms.

A shoe manufacturer, employing 3000 operatives, writes, that after six months' trial they "discontinued the system because the 150 suggestions were not of sufficient value to warrant the continuance of the experiment." In further explanation he adds, "The head of this business from its start 20 years ago, until January 1 of this year, was exceedingly thorough and gave much attention to every detail of the business from top to bottom. . . . Another factor may be the fact that the shoe business has been so long established on methods similar to the present, that there is less chance to make important improvements than in many lines involving more recent inventions or products." The directors had entire charge of this experiment as long as it lasted here, and no employees were on the suggestion committee.

The general superintendent of a large hardware company states, "I should not care to say the suggestion system had been entirely a failure with us, but believe this system, like all others, depends entirely upon the manner of handling it, and like one's product, if it is not continually pushed and improved, it is liable to grow stale, as it were, and gradually to die out, no matter how much merit there may be in it. I do not believe one can put up some one system of suggestions and then sit back and let it run itself."

Another manufacturer gives it as his view that "the suggestion system did not have proper consideration at the time of its introduction, and for no specific reason we have allowed our practices in this subject to fall to disuse. . . . . It is probable that we shall take up the matter at some future date."

A department store abandoned its beginning in this direction, "not because of the good or bad results that might have been obtained," but because of what were considered unfavorable conditions in the matter of the location of the business, the hours of work and the character of the employees.

A clothing house, with an extensive wholesale and retail trade, for a period of "two or three years operated a primitive sort of suggestion system." After a time, rewards at first offered, were dropped because "a very large percentage of the suggestions were utterly impracticable, and the whole proposition got to be a nuisance."

"Now, though suggestions are invited and forms are provided for the purpose, without any incentive in the nature of a reward, we naturally get them only frequently, and in a most desultory way." And to this explanation is added, "The fundamental difficulty in an organization such as ours, devoted principally to the merchandizing of wearing apparel, is that relatively few of our employees have a broad enough view of the firm's policy, of the operation of all the departments, and of merchandise needs and conditions, to be able to make any suggestions which are very much worth while."

From a motor-car manufacturer, I have this: "I am very much mortified to say that we have dropped the suggestion system, principally because we had not the time to give to it, considering the results and benefits we obtained in carrying it on. In order to make the system go, the writer pledged himself to the employees to pass on each and every suggestion, but this became a burden and was dropped. We hope some time in the near future to pick it up and start all over again. The idea is correct, and if the system is properly worked and the confidence of the employees obtained, great benefits can be obtained from the system. . . . . You must see the method in operation and then you can appreciate the great value of the same."

In the three remaining cases before us, the system, such as it was, seems to have died out of pure inanition, there being "no one competent," as it is expressed, to watch over it and to work out the details.

Not a Fair Chance

These, then, are the much-heralded "failures of the suggestion system." But it is apparent, I think, that in not one of these nine cases, was the suggestion system ever given a fair chance—yet it is noticeable that even here where there has been failure, there are not lacking those by whom the system itself is warmly commended. A management imagining itself conversant with every detail of manufacture and sale, from the start puts the system under a strain it cannot withstand, for this is loading it down with that which should be a part of its support, it is like planting a tree wrong end up, and it will not grow that way. It will be seen that the mistake has been made of expecting too much from the individual. The system does not assume the presence of genius behind counters and at machines. It is from the mass of little things that the few big results will follow.

The basis of the suggestion system is the recognition that each operative is an expert in his particular line, as a thinking man as well as a working man. If he does not think much he can be encouraged to think more; if he thinks to little account he can often be trained to think better. The sum total of the directed and encouraged thought of 100 or 5000 experts is worth while, no matter how small the field of their individual vision.

"We feel that it broadens the intellect of all our people," writes one who has long made extensive use of this aid, "as it tends to make them think and question the various actions or operations they have to perform during their day's work and to consider whether they are performing them in the most efficient manner. The advantage is mutual to both employer and employed, as with everyone on the lookout for improvements, defects and wastages, the business has a good foundation."

"It is you who come into practical contact with the working of your own department who have it in your power to make these suggestions," said the head of Lever Brothers at a recent annual meeting of employees at Port Sunlight. "Let us have," he continued, "the benefit of your views or suggestions as to where we can anywhere improve our production, or simply our manufacture, or minimize our waste, and, especially, make for safety in all departments."

What is being done with the suggestion system in the establishments, under consideration can be done in other establishments, no matter what their product, no matter what their working force, and whether they manufacture or distribute, and whether in large quantities or small. But it cannot be done if those in authority feel that having "grown up with the business," they know it in its smallest part beyond any teaching by those in their employ. Heads of departments must also be brought into sympathy with the plan, and all must be made to understand that it is a reflection upon them if those under their control are not fertile in ideas. If foremen are allowed to discourage workmen from using their brains, and if superintendents think that suggestions from those below usurp the prerogatives of those above, the system is doomed to early collapse. The whole force can never pull together on such a basis with unity of purpose and harmony of effort can never be the outcome of such mutual distrusts and pullings asunder.

Will Not Run Itself

The suggestion system will not thrive in such inhospitable soil, nor will it maintain itself without constant and even devoted nurture. It is not a plant which will live without its natural food, nor have we here discovered perpetual motion which needs only once to be set going to continue on till the end of time. "The system needs somebody to look after its details," is the sad conclusion of one who, without this somebody, has seen this system run down and stop. Nor will it do "to encourage in a general way" the making of suggestions, as one of my correspondents states was the policy of his factory where the suggestion system had not strongly commended itself to him. This is not the suggestion system at all. As well build a factory in a "general way," or turn out a locomotive in a "general way." In fact, to encourage in a general way the making of suggestions is no more nor less than to discourage in a particular way the whole suggestion system.

In these collected experiences where this system has been abandoned, or where it is "dormant," as one expresses it, in almost each case one cause for failure lies patent on the surface. The system has been completely in the hands of those at the top, by whom it has been imposed upon the rank and file. A president of a department store writes: "I think the success of our receiving so many suggestions is due to the fact that we have organized a suggestion society. This society meets twice a month. It is composed of employees only, and not a member of the firm is connected with it. . . . . At such meetings there are about 20 suggestions, so that we get forty suggestions per month from our employees."

Has Paid in Every Way

Considering the matter only from the point of view of dollars and cents, I summit that the suggestion system in practice has proved that *where it is properly installed*, it is a money maker. Even at an annual outlay of $10,000 to maintain a suggestion department, with its salaries to clerks and manager, and its rewards and prizes to successful participants, 2969 suggestions adopted out of 13,063 submitted in one year was a result worth many times its cost in money and effort to one organization in this country. And one whose experience in another large American corporation has convinced him of the utility of this system has told me that last year it netted $100,000 to his company.

But we have here more than a producer of additional revenue. The suggestion system fosters good will and cultivates good habits, and makes for peace as well as plenty. "We now know that where anyone can see how to improve a process,

it is probable the improvement will be suggested," writes an iron and steel manufacturer of England, and farther, that "undoubtedly" the system has operated advantageously in improving relations between employer and employed.

The particular procedure which I advocate is something varied, though I believe the farther we get from the democratic standard I like to set up, the more we sacrifice in healthy tone and sustained enthusiasm. Yet, of course, it is true that in individual instances plans have been evolved and brought to success in which the representative committee of the men does not play the prominent part, which seems to me usually desirable. For example, at the large machine shops of Messrs. A. Borsig, in Germany, where, during the past six years, nearly 60 per cent. of the suggestions made by mechanics and skilled workmen have been adopted, the committee of the men is not much more than a general grievance body. But, on the other hand, unusual care has been taken to encourage individual thinking and opportunity is given to every man freely to discuss his ideas with those who are to pass upon them. As a rule, however, the less democratic the organization of the suggestion system, the weaker will be the stimulus to the worker for thought for the common good. Incentive to rival others and to think and study, tends to diminish where there is not a direct representative body of workers to consider at some stage the suggestions of their mates; the suggestion system in time degenerates into a hard matter of bargain and sale and again the incentive toward greater democracy and cooperation, and peace and profits languishes.

Large Prizes Not Desirable

Nor is the remedy to be found through the offer of large prizes. In fact, the larger the prize, the smaller is apt to be the return. Prize hunting rather than the day's work will then become the occupation of some, jealousies and antagonisms will creep in, and managers will be called upon either to expend a considerable sum on many suggestions, good but of trifling value, or they will be led to accept the few of evident worth which they feel can be afforded. And this at once shuts out the average man and puts the whole system on a basis where the men are quick to suspect that rewards are measured out only as their ideas presented are worth more than is paid for them. Men and women working with their hands need to have their interest in their work stimulated to a point where they will devise a cheaper way, a quicker way, a healthier or more attractive way in which to fashion or to sell the composite product of factory or store. They can be encouraged to think as well as to work. As a Canadian manufacturer puts it, "We have some very fine suggestions, and others again have been of very little account, but they are all received in the right spirit, as any suggestion, no matter of how small commercial value, shows that the suggester is thinking along the lines of our business."

All these eyes and hands and brains will do no more than they have been accustomed to. if they are not given incentive and encouragement. The operative will not come out of his rut without a shove. But once out of the rut, often he will go ahead. He begins to see things before passed by unnoticed, and he becomes a better man as well as a better mechanic or better salesman.

A Help in Keeping the Shop Human

Competition in the home markets and in the markets of the world in all industrial countries, and p.eëminently in America, has led to a multiplication of mechanical devices, to more and more specialization, and to ever greater need for economy of material and time. The old days have gone beyond recall. Upon the stage is a new generation of employers and of employees to whom it is not even a memory that masters once knew their men; the old-time skilled workman has given way to the trained operative taking and able to take but a single step; officers, directors, managers and superintendents measure the great gulf fixed between the "hands" and the scattered stockholding owners of today.

One result of this dehumanizing process, we see in mounting returns of annual production fairly staggering the imagination. But on the other side of the account, the new organization of industry shows strikes, labor legislation and a demand for more and more Government control. Too often we find that the workman has become a mere cog in the great industrial machine, to be cast aside when his days of highest usefulness are past, uninsured against accidents inevitable to his occupation, unable to attain a comfortable old age except he be the unusual man able to rise in spite of handicaps placed all about him.

The suggestion system is a protest against the paralyzing effects of the modern factory. It puts an end to the utterly fallacious assumption that a factory manager may be a big or little czar, to whom is due implicit obedience from those who must never stop to reason why. It recognizes that "hands" have heads and that those heads set to thinking can, with the sum total of their small suggestions, produce benefits of large value to the whole industrial organization.

NOTE—Mr. Porter states that he promised to give to those who answered his inquiries the results of his investigation. He assented to use the AMERICAN MACHINIST as the medium of placing these results in the hands of his correspondents and a copy of this number will be sent to each one of them. If further details are desired, write to him in care of this paper, and he will be glad to answer.—EDITOR AMERICAN MACHINIST.

Fixture for Grinding Circular Screw Machine Tools

BY T. H. SYLVAN

The illustration shows a fixture designed for holding circular screw-machine tools while grinding the cutting face. A cast-iron base is provided with slots for bolting to the grinder table and a tongue for fitting the slot. Into the web *B* are tapped four square-head setscrews *C*, provided with check nuts *D*. These are for setting the grinding wheel to grind different distances below center, and are adjusted and locked in place, and the table is raised until the grinding wheel just rests on one of these screws.

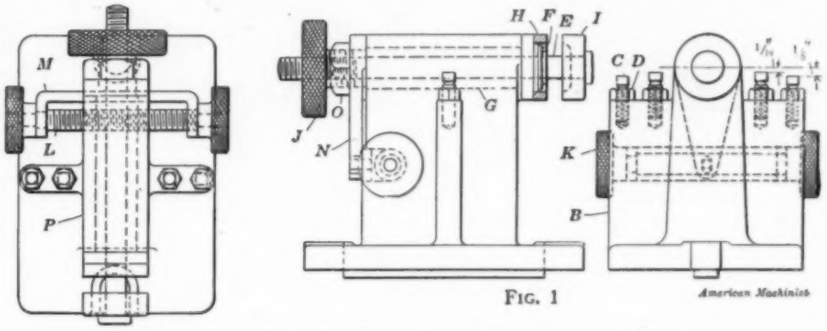


FIG. 1 FIXTURE FOR GRINDING CIRCULAR SCREW-MACHINE TOOLS

The cutter to be ground is mounted on the spindle *E*, if it is for the No. 00 Brown & Sharpe machine, and on one of the steps *F*, on the shaft *G*, if for a larger size machine.

Collars *H* of various thicknesses are used, depending on what step the cutter is mounted.

The cutter is securely clamped in place between the collar *H* and washer *I* by tightening the nut *J* on the end of *E*.

The cutter is revolved by turning the nut *K* on the screw *L*, which is tapped through the web *P* of the base. Turning the nut moves the yoke *M* back and forth. The arm *N* is connected to the yoke and clamped against the end of the shaft *G* by means of the nut *O*.

When the grinding is finished, the cutter is removed from the fixture by loosening the nut *J* and removing the spindle.

Making Gaggers—Permanent Iron Mold—Chills—A Molding Pit

EDITORIAL CORRESPONDENCE

Fig. 1 shows a double sided gagger machine. When the one side is poured it is turned over and the other side is ready to pour. The molds or depressions may be of any shape to suit requirements. Fig. 2 shows a permanent mold for casting the weights *A*. These are 22 inches diameter by one inch thick and weigh approximately 100 lb. Formerly two handy men using a roll-over machine could make about 18 of these a day. In the cast-iron mold shown the same number can be cast in a little over half an hour, about 2 minutes each. The mold itself is about 4½ inches thick. The side *B* is flat except for the permanent core *D*. The side *C* is recessed the thickness of the weight. The machine is bolted to the floor. The whole affair is heavily built. Fig. 3 shows the chills used as cores for cylinders for steam and gas engines, etc. The chills are built up as shown. The spaces between the ends are about 3/16 inch to allow for shrinkage. They are filled with stiff plumbago to prevent the iron from running in between. The space in the center is packed with green sand. For smaller cylinders the chills are built into the core box and after being rammed up with core sand the whole core, chills and sand, is dried in the core oven. The chills for the larger sizes of cylinders are very flexible; one size of chill will do for a large variety of sizes of cylinders, and it takes less time than it does to make a regular core. The effect of the chills on the iron is very noticeable. The grain is close and hard, though not too hard to machine. The bores of the finished cylinders look as though they had been polished.

Fig. 4 shows a molding pit which has many advantages. The wall is of boiler plate which prevents the whole foundry floor from caving in when a pit for a large casting has to be dug.

The pit as shown is cleared ready for a large cylinder mold. At *A* can be seen the core built up of chills as shown in Fig. 3. The views shown were taken in the shops of the National Transit Company, Oil City. Penn.

FIG. 1. GAGGER MACHINE

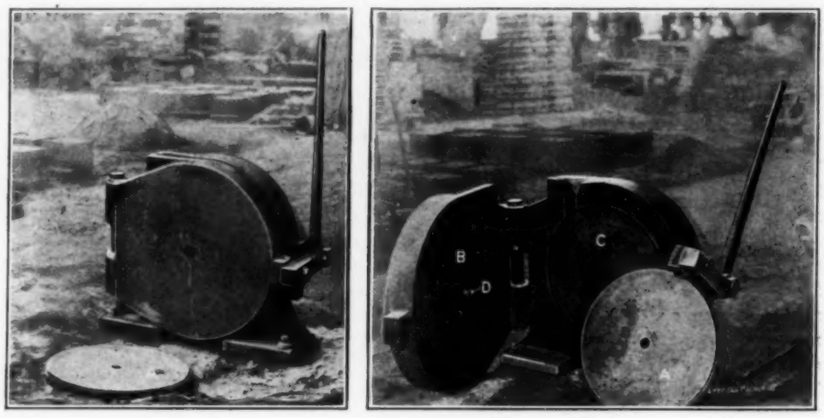


FIG. 2. PERMANENT MOLD FOR IRON WEIGHTS

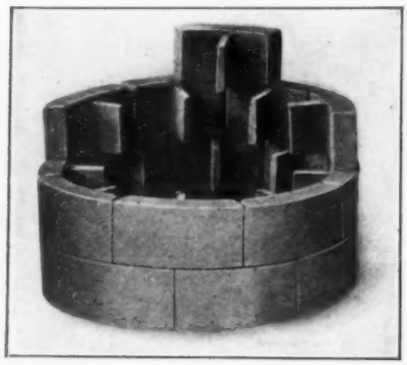


FIG. 3. CORE CHILLS FOR CYLINDERS

Acid Resisting Bronze

An acid-resisting yellow brass suitable for making screen plates, used in sulphite mills, has, says the *Foundry*, never been discovered, alloys of copper and zinc being peculiarly susceptible to corrosion. Therefore, it is the usual practice in making screen plates to employ an alloy that contains considerable lead. This is done for two reasons. Lead being an acid-resisting metal, it is supposed to impart similar properties to the metals with which it is alloyed, and because of the large amount of machine work that has to be done on these castings, it is important that the metal may be easily machinable. Probably the most satisfactory alloy that could be used, from an acid-resisting standpoint, would be a good bronze, made of copper and tin, containing no zinc and the minimum amount of lead that would permit the metal to be freely cut. Cost considerations, however, are often all important, and preclude the use of such expensive material; therefore, it is not unusual for these plates to be made entirely of scrap brass leaded to the limit. The composition of two alloys suitable for red-brass screen plates is as follows: Copper, 86 pound ; lead, 9 pounds; tin, 3 pounds; and zinc, 2 pounds. Copper, 85 pounds; lead, 8 pounds; zinc, 4 pounds; and tin, 3 pounds.

FIG. 4. MOLDING PIT

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For July,* 1911 *(American weekly, American monthly, English weekly and German weekly), total,* 111,250.

Of this issue 22,750.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 133

American Machinist

Grease Lubrication for Machinery Bearings

When designing lubricating devices for machinery bearings, it is possible that some attention may be given to the relative merits and demerits of oil and grease as a lubricant.

There are earnest advocates for each.

Grease is peculiarly adapted for conditions of high pressure and slow speed, conditions where an oil would be squeezed out from between the mating surfaces, thus making it difficult to establish, much more maintain, a proper film. Grease is likewise peculiarly advantageous in places difficult to lubricate by ordinary means. A quantity of grease in a spring compression cup can be relied upon to lubricate an inaccessible bearing for some time, depending, of course, upon the surrounding conditions.

Aside from these places where grease is undoubtedly superior as a lubricant, it is doubtful if all of the claims made for it can be substantiated. One of the most important claims for grease is its economy.

Taking the manner in which the average machine is handled, there is undoubtedly a real comparative saving in the use of grease owing to a lessening of waste. Dripping grease makes a dirty, disagreeable looking mess. Thus drip pans are invariably provided. Furthermore, grease is not thrown about in small drops and is not atomized by air currents. Thus the waste of grease under the ordinary conditions of its use is less than the waste from oil under its ordinary conditions of use.

But even if this and other savings are sufficient to make out a balance in favor of grease over oil, what shall we say about the friction losses? If the friction resistance in a grease-lubricated bearing is greater than the corresponding resistance in an oil-lubricated bearing, the increased cost of power transformed into heat through the work of friction must be charged up against the grease. We are led to believe that this may be a very important item. Beauchamp Tower reported to the British Institution of Mechanical Engineers in 1883 a comparison made experimentally by him between five different oils and one grease. The results are shown in the following short tabulation:

Lubricant	Mean Resistance, Pounds	Per Cent.
Sperm oil	0.484	100
Rape oil	0.512	106
Mineral oil	0.623	129
Lard oil	0.652	135
Olive oil	0.654	135
Mineral grease	1.048	217

Here it is seen that the frictional resistance due to the grease is nearly double that due to a mineral oil. In each case the experimental bearing was flooded with lubricant; that is, the journal was actually resting in a bath of the oil or grease. Care was taken to keep all of the surrounding conditions uniform throughout the series of observations.

One of the unfortunate things in regard to this matter and the major point that we wish to bring out, is the lack of comparative experimental data in regard to oils and greases as lubricants. It is earnestly to be desired that someone should take up this matter in a spirit of engineering research and give us a knowledge of the comparative frictional resistances of various lubricants, in order to determine their relative savings or losses.

Aeroplane and Motor Car Accidents

Anyone who is fond of quoting "consistency thou art a virtue" in a tone that implies that that particular virtue is extinct, if it ever existed, or who delights in pointing out the gulf between precept and practice, must be in his glory if he has stopped to consider, on the one hand the movement to reduce industrial accidents, and on the other the rapidly increasing totals of deaths and injuries from aëroplane and motor-car disasters. On the one hand there is a demand from men of all classes that safeguards shall be developed and that industrial accidents must be reduced in number. On the other hand, there is a demand for spectacles and races where frail machines are driven at enormous speeds in the face of tremendous hazards, that people may be thrilled at the sight of fellow human beings courting danger and shaking hands with death.

We recognize that nature seems to guard many of her secrets jealously. Every great step forward that bends nature's forces to human comfort; every great engineering achievement and many scientific discoveries have taken toll of human life. In the early days of the motor car and aëroplane such toll was to be expected. The risks then taken and the dangers braved were justifiable, in order that human knowledge and accomplishment might be advanced. But that stage has long since been passed. The aëroplane accidents of today seem to come from foolhardiness. Machines are damaged and crippled when in flight and become the direct cause of fatalities, but in some cases at least this crippling arises from simple abuse. The spiral dives and other acrobatic feats in the air must tend to overstrain the structure of the machines. What wonder then that some of them collapse at critical moments!

This may be taken as showing the need of further scientific investigation of air resistance and its associated problems, and an engineering study of aëroplane design. We have pointed out before that probably the factors of safety in aëroplane design are unknown, and certain facts tend to show that they may be very low, much lower than those used in fixed structures or in devices of transportation.

Two recent motor-car accidents show the utter carelessness of some drivers. In both a car was cut to pieces by a railway train, and the facts indicated that the chauffeurs simply drove upon the tracks without taking any pains to ascertain whether or not a train was approaching. For three generations inhabitants of this country have been familiar with the posts at railway grade crossings, bearing the admirably phrased warning, "Stop! Look! Listen!" Apparently certain automobile drivers think that this applies to slow-moving horse-drawn vehicles, and that the fast automobile is under no necessity of employing such simple safeguards.

In the field of industry we do not hesi-

tate to turn to legislation to provide a means of protecting the industrial worker against his own thoughtlessness and carelessness. Why should we not use similar means to prohibit the doing of things that put the aviator and motorist in danger, or that imperil others?

New Publications

Alphabetical and Segregated List of the National Machine Tool Builders' Association. Compiled by the Secretary. Thirty-five 6x9-inch pages. Published by the association, Charles E. Hildreth, secretary, 134 Gold street, Worcester, Mass. Price, 50 cents.

This pamphlet has been carefully compiled and revised. It gives the names of all the members of the association in an alphabetical list, and again in a classified list gives the names of all the makers of each kind of machine tool, etc., under machine and small-tool headings, also arranged alphabetically. The list is distributed free to members and is for sale to others as indicated in our heading.

Report of the United States National Museum for the year ending June 30, 1910. One hundred and forty-six 6x9-inch pages; no illustrations. Government Printing Office, Washington, D. C.

The report on the progress and condition of the United States National Museum for the year ending June 30, 1910, issued by the Smithsonian Institution, shows that the funds available by appropriation of Congress for that year were $565,500. The development of the new building for museum purposes is reported upon, and it is expected that it will be formally opened soon after Congress convenes for its regular session in December of this year. The total number of accessions to the museum for the year is approximately 971,000. Only a few, however, are of such a nature that they will enter the Museum of Arts and Industries. The more important of these are: 82 rifles, carbines and muskets which have been kept as an exhibit at the League Island navy yard in Philadelphia; two sets of the aëro-dynamic models, devised and used by Doctor Zahm in determining the atmospheric resistance of various bodies with reference to hulls of vessels and flying machines; a pin-making machine, invented by Doctor Howe, in 1835, and said to be the first successful machine constructed for automatically making complete pins; a collection of 153 watches and chronometers; 272 Japanese instruments, mechanical gages and primitive implements, and a loan collection of 133 guns, pistols, swords and other small arms.

Cost Keeping and Scientific Management. By Holden A. Evans. Two hundred and fifty-two 6x9-inch pages; 44 illustrations in the text; indexed. McGraw-Hill Book Company, New York City. Price, $3.

Reviewed by Dexter S. Kimball*

In this book Mr. Evans has done a great and good work for the small manufacturer, and for that matter, for the large manufacturer as well. Its aim is to lay before small manufacturers the general principles of cost accounting and so called scientific management, and to show how these may be applied to a comparatively small shop. Much has been written about the broad features of these modern methods, usually in such a voluminous manner that the manufacturers, especially the smaller ones, are overawed and frightened by the array and have failed therefore as a usual thing to profit by such duscussions.

Mr. Evan's book brings these principles down where the everyday manufacturer can grasp and apply the most important principles.

Chapter 1 discusses the great need of accurate cost accounting and the failures which ensue from lack of such methods, the reasons why so few such systems are to be seen, and a clear discussion of the difference between cost keeping and ordinary accounting.

Chapter 2, entitled: "The Purposes of a Cost System," discusses the various items of information which can be obtained from a cost system and the deductions which can be drawn from systematized costs.

Chapter 3 is an analysis of the various elements which enter into costs, such as direct and indirect labor, material, depreciation, taxes, interest and rent. The discussion of the last two items will be illuminating to many shop owners and cost keepers.

Chapter 4 deals with the problem of distributing costs. The difficulties surrounding the problem are discussed and the several methods with their defects are noted. Finally a skeleton outline of a simple system of distribution is given, which should prove very helpful to those who have no such systems and are anxious to make a beginning.

Chapter 5 deals with the details of such a system, such as production orders, shop orders, and is illustrated by sample blank forms. Methods of checking men in and out of the works and the receiving and recording of cards are also discussed.

Chapter 6, entitled: "Indirect Charges," contains excellent sample classifications and subdivisions of the several items which constitute indirect charges, combined with a simple system of mnemonic symbols for identifying them.

Chapter 7 discusses methods of analyzing costs and methods of reducing expense, with some excellent paragraphs on the dangers of superficial criticisms of costs by those who are not versed in the theory of cost accounting and manufacturing.

Chapter 8 is devoted to a discussion of the several methods of rewarding labor. The theories of Halsey, Taylor and Gannt are stated and discussed.

Chapter 9, entitled "Management," deals with fundamentals of shop management, and the author shows that the fundamental principles of so called scientific management are, for the most part, common-sense rules of good management.

Chapter 10 deals with the detection of wasted time by simple time studies and is interesting in its simplicity and the actual examples quoted.

Chapters 11 and 12 are among the most interesting in the book. In these the author shows what can be done in almost any shop to apply modern methods of shop management. They should be of particular interest to the small manufacturer who does not know where to begin.

Chapter 14 shows, by way of example, the application of the methods discussed to several kinds of shops, such as blacksmith, wood-working and flag shops.

In the last chapter the author shows actual results and savings which have been accomplished by better methods.

In the preface and elsewhere, Mr. Evans states that many of these results have been obtained by following the principles of management advocated by Mr. Taylor. As a matter of fact, however, many of the methods described are and have been in common use for many years in uptodate shops. In fact the principles of management which Mr. Evans deduces from Mr. Taylor's work, as listed on page 118, are and have been known and practiced in many shops for years, though not in the refined degree advocated by Mr. Taylor.

No one can read the book and not believe that Mr. Evans is largely responsible personally for the results he has obtained, and one lays it down with a feeling of satisfaction that it comes from the pen of one who has actually done something along these lines, and has given his experience in such a manner as to be extremely useful.

The book is especially adapted to the small manufacturer or jobber, but will also be a mine of information to many large operators, and should be in the library of every live manufacturer.

*Professor of machine design and construction, Sibley College, Cornell University.

In an investigation on the efficiency of rope drives by a German commission, it was found that with pulleys of 100 and 60 inches in diameter and a 40-inch idler, the efficiency of the drive drops off 10 per cent., due to the presence of the idler.

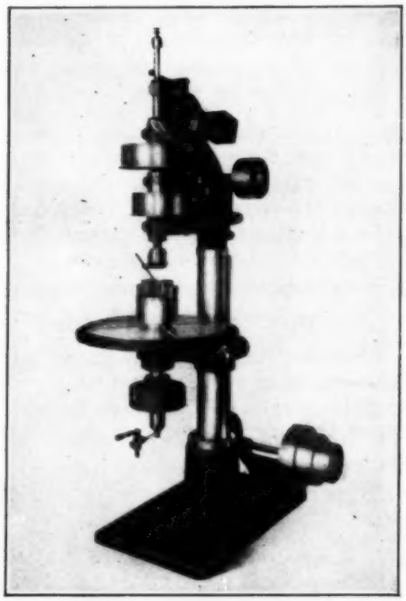
Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Automatic Tapper

The illustration herewith shows an automatic tapper recently developed by the Garvin Machine Company, New York City. The machine has a special chucking arrangement mounted on the table, consisting of a Garvin automatic, wrenchless two-jaw chuck operated by compressed air. A turn of the air valve operates the chuck jaws instantly.

The spindle is fitted with two friction pulleys, driven in opposite directions by one continuous belt, and between these pulleys is placed a friction clutch, keyed to the spindle. The friction clutch is connected with a lever at the right by a



AUTOMATIC TAPPER

toggle arrangement, which is adjustable for the desired tension, so that any extra safety device to prevent the breaking of taps is unnecessary. The tap is started by the lever at the right, and is tripped and reversed automatically at any point, by an adjustable screw stop on the upper end of the spindle striking the tripping lever on the top of the machine.

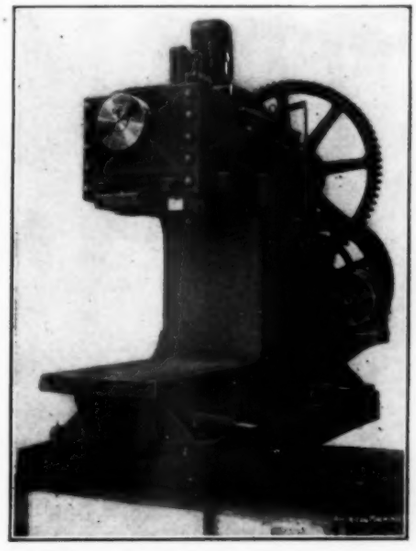
The spindle is balanced and fitted with a positive drive chuck for holding the taps. The table is surrounded by an oil groove, and is adjustable up and down on the column to suit the work.

The machine can be operated at high speeds, and will trip and reverse after being set, though the operator should continue to press down on the starting lever. The machine will tap from ¼-inch to ⅞-inch United States Standard taps in cast iron, and ¼ inch to ¾ inch in steel; ½-inch pipe taps in cast iron and ⅜ pipe taps in steel.

Multiple Punching Machine

The accompanying illustration shows a very large coping multiple-punching machine, especially designed and built by the Queen City Punch and Shear Company, Cincinnati, Ohio, for the purpose of coping and punching sections on the Bethlehem I-beams.

It is the first machine ever built solely adapted to the above purpose, and has a very large range between the ram or plunger, which is of solid-steel casting, and is 42 inches long by 14 inches wide, having T-slots to fasten the various tools and appliances; the die bed is 62 inches from back to front and 30 inches wide. The clutches are of steel castings and the machine weighs over 63,000 pounds.

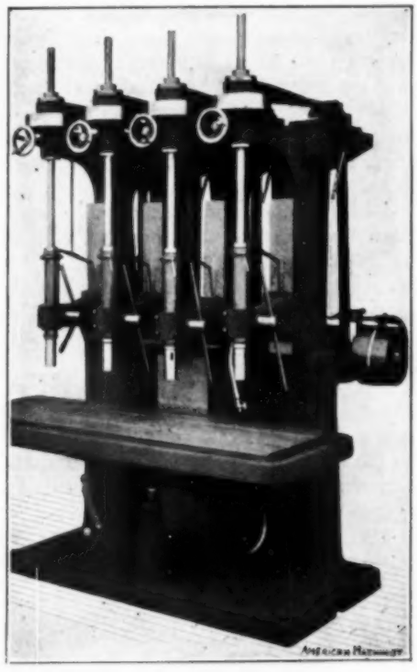


MULTIPLE PUNCHING MACHINE

High Speed Ball Bearing Driller

The accompanying halftone shows a high-speed ball-bearing driller recently developed by the Cincinnati Pulley Machinery Company, Cincinnati, Ohio.

The machine has a capacity up to the limit of No. 3 shank drills. The spindle is 1 3/16 inches in diameter and is bored



HIGH-SPEED BALL-BEARING DRILLER

No. 3 M. T. The countershaft diameter is 1 11/16 inches. The pulleys are arranged for 2-inch belt. The distance from spindle center to column face is 12 inches, and the spindle sleeve has a feed of 8 inches without resetting the head. This spindle sleeve is graduated and has the stop collar or depth gage mounted on it so that it can be set for a precise depth of hole without use of measuring scale. Four changes of speed are provided for each spindle, and the machines are built in either single or multiple spindles. Each spindle is provided with belt-tightener carriage, controlled from the front of the machine by handwheel and screw feed. This gives positive and precise belt tension. The weight of the four-spindle machine, as shown, is approximately 4000 pounds. The machines

can be supplied with lubricating outfit, the inside of the lower part of the column forming the tank. Tables can be supplied with T-slots or not, as desired. The table is provided with a heavy oil groove to take care of the lubricant.

Rail Ending Machine

The accompanying halftone shows a rail-ending machine, consisting of a very large spindle, on which is mounted a head carrying three tools caused to revolve by a powerful worm wheel to be used for making short cuts on the ends of railroad tracks and girder rails for street railways.

It is particularly desirable for squaring the ends where the length to be removed is too frail to support a saw blade rigidly enough to give a square cut.

The spindle is 8 inches in diameter, has a length of bearing overall of 41 inches, revolves in bronze-bushed capped bearings; the spindle is driven by a bronze worm wheel 33 inches in diameter, and the worm is of hardened steel fitted with roller-thrust bearings, both of which are incased for continual lubrication. The feed is obtained by change gears, four in number, operating a bronze nut on the 3½-inch diameter stroke; there is also hand fast traverse to bring the cutters up to the work. The work table is 31 inches long and 40 inches wide, has T-slots on the sides and top and removable clamps for securely holding (in this case) the built-up switches.

The base of the machine is cored as shown, to permit the escape of chips, and an oil pan is cast solid with the base of the machine, and pump, piping and attachments for lubrication are furnished; the reservoir is located in the base. The cutter head is 16 inches in diameter over the tools, which are 1¼ inches thick.

The machine is driven by a Westinghouse type S. A. frame No. 6 15-horsepower, 500- to 1000-revolution per minute motor. It occupies a floor space of 9 feet 6 inches by 8 feet 6 inches, and is a recent product of the Newton Machine Tool Works, Philadelphia, Penn.

Quick Action Manufacturers' Vise

The illustration shows a new type of vise which the Pratt & Whitney Company, Hartford, Conn., has recently placed upon the market. These vises have been extensively used with success by this company upon milling equipments, especially for gun work. The design is very compact, and in operation it has practically the rigidity of a solid casting.

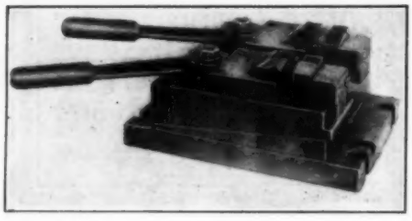


FIG. 1. QUICK-ACTING VISE—DOUBLE TYPE

In operation it works exactly opposite to the ordinary screw vise in that the inner jaw, against which practically all of the working strains come, is bolted stationary, the outer jaw being movable. The outer jaw handle, which is made from a steel forging, passes underneath and is supported by the stationary jaw. It is actuated by a hardened cam which is forged integral with the operating lever. The form of the cam is of such a nature as to give a rapid and efficient binding action and at the same time give a wide opening to the jaws. The construction is such as to easily permit the removal and insertion of the various jaws.

The vise is made either single or double in sizes suitable for Pratt & Whitney hand, No. 2 column power, and Lincoln millers. When made double one set of jaws is supported by a wedge, as shown,

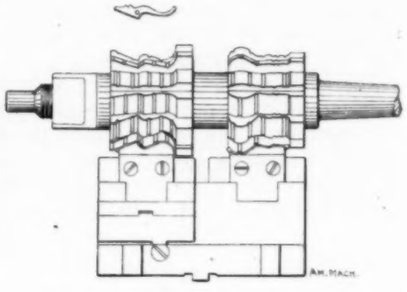
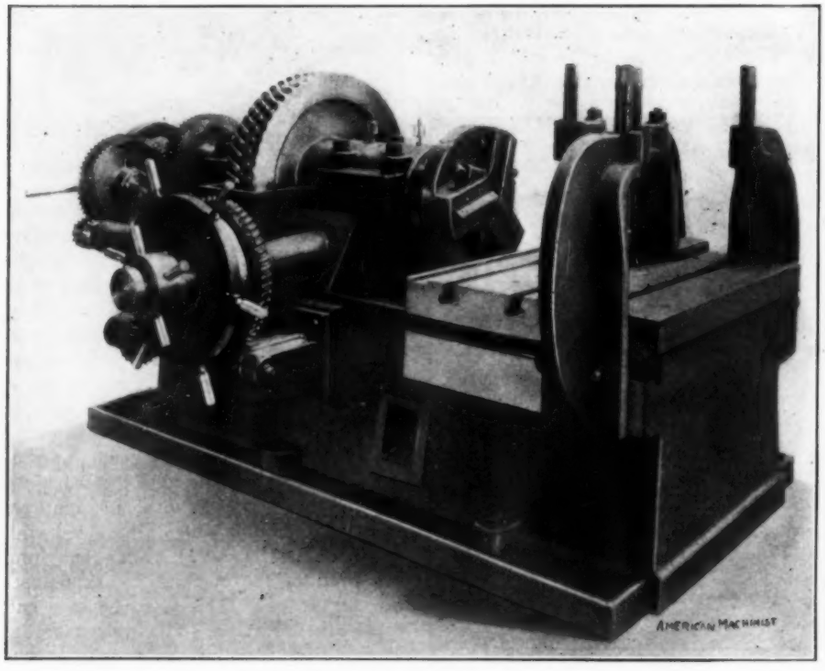


FIG. 2. METHOD OF APPLICATION

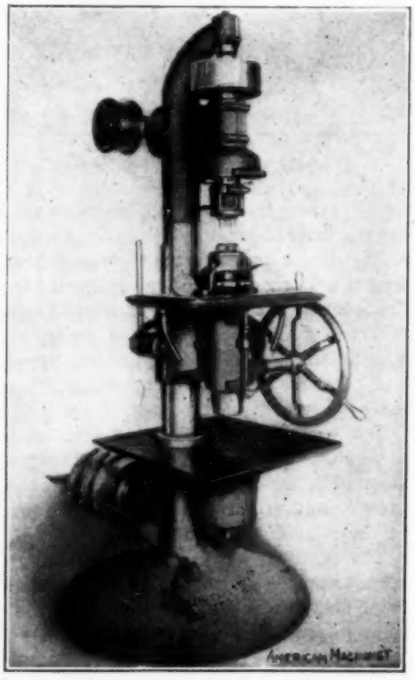
by means of which a vertical adjustment is obtained to compensate for any variation of milling cutters due to uneven wear. The vise may be readily arranged to accommodate a large variety of work by means of special jaws.

Multiple Spindle Driller

Illustrated herewith is a large size multiple driller of the raising-table type, manufactured by the Langelier Manufacturing Company, Providence, R. I. It



RAIL-ENDING MACHINE



MULTIPLE-SPINDLE DRILLER

was adapted in this case for drilling meat-cutter plates, and is equipped with six interchangeable heads, each with a different layout of spindles and a table fixture for locating, holding and indexing the cutter plates during the process of drilling the holes. Each head is furnished with a four-leg cradle for safe keeping when not in use, and also to facilitate handling and adjusting them to and removing them from the machine.

The drilling heads are self-contained and are easily and quickly interchanged by means of the cradles before mentioned.

The heads and spindle drivers are made of bearing phosphor bronze, and the drilling-spindle holes are bored to within a 0.0005-inch limit as to location. The spindles are of tool steel and cut out of the solid bar. They are hardened, tempered and ground true to size, and are fitted with pinch chucks for taking listed straight-shank, tongued-wire twist drills.

The steady jig shown in the halftone is clamped to the lower end of the drill head and is adjustable vertically to allow the cutting ends of the drills to project out just sufficiently to drill through the cutter plate.

The drill-head casing is removable and other casings may be fitted to take in larger heads in which the spindle layouts are not larger than an 11-inch circle.

The main driving spindle is 1 5/16 inches in diameter, and runs in loose perforated bushings in both upper and lower bearings, thereby increasing its resistance to wear and heating up at the high speed at which it runs.

Lubrication to all high-running parts connected to this spindle is effected through a capped brass oiler screwed into the upper end of the main spindle, the oil leading down through a hole drilled the entire length of the main spindle to the drilling head. The oil in gravitating and by its centrifugal tendency lubricates the upper and lower bearings. A separate oil well is also provided for the upper bearings.

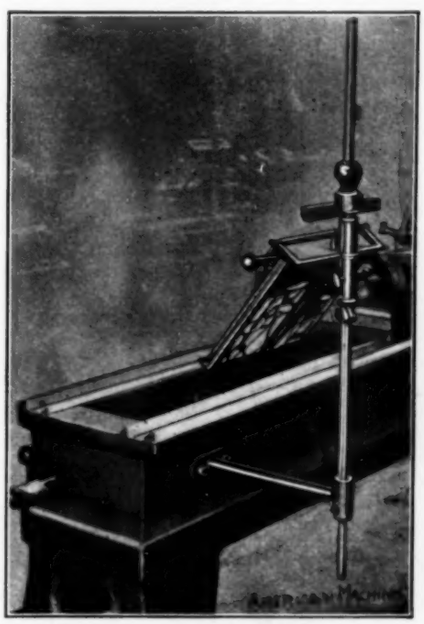


FIG. 1. METHOD OF FASTENING BLUEPRINT HOLDER TO BED OF LATHE

FIG. 2. TEXTBOOK HOLDER FASTENED TO BENCH

Holder for Blueprints and Instruction Books

The illustrations show the holder for blueprints and books which was designed by Robert H. Smith, instructor at the Massachusetts Institute of Technology.

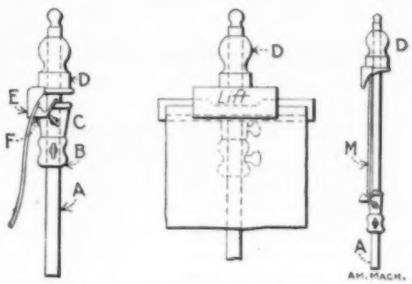


FIG. 3. DETAILS OF HOLDER

The photographs show two applications of the holder, one to a lathe and the other to the bench, while the detailed drawing shows how it is constructed and the way in which both mounted and unmounted prints are held.

The holder consists primarily of the steel rod *A*, supported in any suitable manner and carrying the adjustable pieces *B*, *C* and *D*. Unmounted prints are held between the points *E* and *F* and are released by simply raising the piece *D*. Mounted prints are held as shown at *M*, the upper and lower edges being held by *C* and *D*. In either case they may be adjusted to any desired hight, instantly released, and yet firmly held in a convenient position for the student or workman.

The book holder, shown in both halftone illustrations, is particularly for students' use and consists of a frame or holder at an angle supplied with a celluloid cover which is dropped down over the open book and serves the double purpose of holding the book open at the desired place and also of keeping it clean. These are made by the Educational Book Company, Boston, Mass.

The Toolmaker and the Detective

We do not know what kind of a disguise a tool- and diemaker would assume if he wished to pass himself off as a detective, but the following little story from the *New York Times* shows how detectives go about it when they are obliged to dress the part of the skilled mechanic. They were looking, by the way, for a man supposed to be employed in a garage.

"The detectives, assured that they were now on the right trail, went to Manhattan and began inspection of all Broadway garages. They equipped themselves with carpenters' rules, and whenever Patton entered a garage they busied themselves measuring the sidewalk with their rules. Thus they hoped to avoid all suspicion. Detective Patton was dressed as a laborer. He wore no outer shirt, and his undershirt was visible where his coat did not cover his body. He had a long growth of beard, and this was of good service to him in his rôle of tool- and diemaker."

It would appear from the foregoing account that a toolmaker looking for employment should add to his usual equipment a visible undershirt, a full beard, and a carpenters' rule with which to measure sidewalks.

Incidentally, it may be mentioned the detectives found their man. It seems that tool- and diemakers are so accustomed to looking for work in garages that the presence there of Old Slouch himself would create no suspicion provided his disguise consisted of the toolmakers' conventional beard, undershirt, and 2-foot rule.

Of 3875 known causes of fire in Chicago last year, 1089 were due to the careless use of matches. Nearly 10,000 matches are scratched every second of the day in this country, every one a possible fire. Fifteen hundred people are killed and 5000 are injured annually as a result of fire.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The Bernstein Spring Wheel Company, Augusta, Me., has been recently incorporated.

The Morgan Silver Plate Company, Winsted, Conn., will erect a two-story addition to its plant.

Contract has been let for the construction of an addition to the United States Steel Company's plant in Worcester, Mass.

The L. S. Starrett Company, Athol, Mass., manufacturers of mechanical tools, has started work on an addition to its plant.

Fire destroyed the roundhouse, repair shops and nine locomotives of the Maine Central Railroad at Calais, Me. Loss, $110,000.

The Shickel Motor Cycle Company has taken a factory on Garden street, Stamford, Conn., and will manufacture motor cycles.

The Geyser Electric Company, New York City, has been incorporated under the laws of West Virginia, with a capital stock of $1,500,000. The company is to manufacture electric apparatus. Incorporators are H. Sutherland, F. E. Anderson and M. B. Bacharach, of Hartford, Conn.: Andrew R. Nichols, of Seattle, Wash., and Geo. S. Landers, Boston, Mass. The main works are to be located in Hartford, Conn.

MIDDLE STATES

The Bradley Axe Works is planning to establish a plant at Peekskill, N. Y.

Chase Motor Truck Company, Syracuse, N. Y., is building an addition to its factory.

Geotz Automobile Radiator Company, Chicago, Ill., has filed certificate of incorporation.

C. W. Hacker has let contract for a garage at Sheldon and Wister streets, Philadelphia, Penn.

The Navoe Auto Company, of Norwich, N. Y., has recently been granted a certificate of incorporation.

The American Metal Bed Company, Newark, N. J., has been incorporated with a capital stock of $100,000.

Incorporation certificate has been filed by the Cincinnati Fire Extinguisher Company, Cincinnati, O., for the purpose of manufacturing fire extinguishers. Capital stock, $50,000.

The American Car and Foundry Company, St. Louis, Mo., has completed negotiations whereby it will build a large plant in Gary, Ind., calculated to employ about 6000 men.

Automobile Construction Company, Chicago, Ill., has been incorporated to manufacture automobile parts. Incorporators, Harry M. Wells, Albert T. Graham, William E. Fuller.

The Lauth-Juergens Motor Car Company, of Fremont, Ohio, will soon start the erection of a large addition to its plant. The addition will be located in the rear of the present structure.

W. A. Paterson Company, Chicago, Ill., incorporated for the purpose of manufacturing gasolene and electric automobiles. Incorporators, Edgar C. Frady, Wm. B. Herrick and L. A. Closter.

The Eclipse Clutch and Manufacturing Company, Evansville, Ind., has been incorporated with $100,000 capital to manufacture automobile clutches. J. W. Ford, A. L. Swanson, J. G. Beckman, J. L. Scheuble and E. C. Altenbernd.

The Barry Automatic Specialty Company, Chicago, Ill., has been incorporated with a capital of $10,000 to manufacture automatic slices, machinery and specialties. Incorporators, Henry Barry, Chas. E. Boughner and William A. Jennings.

The Pritchard Stamping Company, Rochester, N. Y., has taken over the buildings formerly occupied by the Mystic Milling and Feed Company, Main street, Rochester, and it is reported will use the buildings for a nickel-plating works.

The Kling Brothers Engineering Works, Chicago, Ill., has been incorporated with a capital stock of $250,000. The company is to manufacture machinery metals and metal products. Incorporators, Chas. J. Kling, E. N. Bessel and J. J. Ludwig.

The Armor Steel Foundry Company, of Matthews, Ind., which controls the Gebhart process for hardening steel, has purchased the plant of the Cincinnati Steel Foundry Company, at Winton place, Cincinnati, Ohio, and will remove to that point.

The Baby Engine Company, New York City, has been incorporated for the purpose of manufacturing engines, machinery, etc., with a capital of $100,000. F. Hoar, H. N. Richardson and J. Ingle, Jr., of New York City, are the incorporators.

SOUTHERN STATES

A large machine shop and warehouse is to be erected on Claggett street, South Baltimore, Md., for use of the Page Engineering Company.

The Modern Machine and Vulcanizing Company, Henderson, Ky., has been incorporated. Incorporators, S. Loeb, A. Kieffer and J. H. Gillispie.

A modern plant is soon to be constructed by the Converse Bridge Company on the site of its Rigedale factory, Chattanooga, Tenn., recently destroyed by fire.

The Senn Press Steel Hoe and Tool Company, Birmingham, Ala., expects to erect a plant in the Birmingham district within the next few months for the manufacture of the Senn hoe.

WEST OF THE MISSISSIPPI

H. Eberhard, Ross street, Portland, Ore., will build a new machine shop.

E. E. Coovert, Portland, Ore., will build a commercial garage and repair plant.

The Colorado Metal Culvert Company has been moved to Pueblo, Colo., and it is to be enlarged.

The California Cornice Works, Los Angeles, Cal., metal workers, will build an addition to its plant.

The Architectural Iron and Bronze Company, San Francisco, Cal., is having plans prepared for a new foundry.

S. L. Turner, Los Angeles, Cal., has taken out a permit to build a commercial garage and repair plant. Modern equipment will be installed.

Theodore Dierks, San Francisco, Cal., has taken out a permit to build an automobile machine shop. Modern machinery will be installed.

The Northern Pacific Railroad will build a new machine shop, boiler plant and roundhouse at Auburn, Wash. Plans have been prepared.

The Standard Steel Tie Company, Phoenix, Ariz., has been incorporated by O. N. Kelly and J. W. Wright. Offices will be established at Phoenix.

The Dils-Miller Keyseated Self-locking Nut Company, Tacoma, Wash., has been incorporated by L. A. Dils and A. A. Miller. Offices will be established at Tacoma.

The George Gartling Company, Los Angeles, Cal., manufacturers of automobile supplies, making a specialty of welding work, hs leased quarters on North Main street, and will establish a new plant.

The Speer Trolley Company, Salt Lake City, Utah, recently incorporated, is planning for the erection of a plant for the manufacture of a patented trolley pole. A. J. Lewis is interested in this company.

In addition to rebuilding its shops at Tucson, Ariz., the Southern Pacific Railroad is planning for the erection of repair shops for heavy work at Phoenix, Ariz.; $400,000 is said to be appropriated for this work.

The Great Western Power Company, San Francisco, Cal., will build a new machine shop at Nevis, Cal., in connection with its power-plant construction in this district. The company also plans to install a lighting and power system at San Jose, Cal.

CANADA

The Canadian Fairbanks Company will equip a large plant at Winnipeg.

The Westport Foundry will build a $10,000 foundry, at Westport, Ont., Can.

The Perrin Plow and Stove Company, Smiths Falls, Ont., will double its plant.

The Rudel Beinap Machinery Company will locate a new factory in Montreal, Can.

The roundhouse of the Canadian Pacific Railroad, Golden, B. C., was destroyed by fire.

The Nova Scotia Carriage and Motor Company will build a big new factory at Kentville, N. S.

The McLaughlin Carriage and Automobile Company, of Oshawa, Ont., will locate a branch factory at Saskatoon, Can.

Messrs. J. Robinson & Sons, Niagara Falls, Ontario, Canada, will buy a quantity of electrical equipment and a shaper, driller, lathe, etc.

General Manufacturing

NEW ENGLAND

The Chase Rolling Mill Company, of Waterbury, Conn., will build a new store house.

The Morgan Silver Plate Company, of Winsted, Conn., will build a two-story addition.

The New York, New Haven & Hartford Railroad will build a new boiler house and work shop on Southbridge street, Worcester, Mass.

The newly organized firm of Dudley, Wears & Stevens, with a capital of $50,000, will commence the manufacture of shoes in Lowell, Mass., October 1.

F. W. Konold, Collinsville, Conn., is building a coal elevator with a capacity of 400 tons, same to be equipped with hoisting apparatus and electric motor.

A building permit has been issued to the New Haven Pulp and Board Company, New Haven, Conn., for the erection of additional buildings to its plant estimated to cost about $20,000.

Chelsea, Mass., will build a large addition to the Shurtleff school-house group. Heating and ventilating is to be by the fan system with humidifying apparatus. A new boiler is also to be added.

The Flynn & Doyle Company, Litchfield, Conn., has been incorporated for the purpose of manufacturing wagons and other vehicles. J. F. Doyle, Chas. Flynn and H. F. McIntyre, all of Litchfield, are the incorporators.

The New England Zinc Corporation, Stamford, Conn., has incorporated with $100,000 capital to smelt minerals, drill oil wells, and to construct and operate private tramways. Incorporators are R. M. Andrews, Fred C. Parsons and Dr. John E. Martin.

MIDDLE STATES

The Detroit Bath Tub and Brass Works is to erect an addition to its factory at Detroit, Mich.

The Lowell Specialty Company, of Lowell, Mich., is soon to construct an addition to its plant.

The American Rolling Mill Company, Zanesville, Ohio, will install some stock-handling machinery.

The Muskingum Coffin Company, Zanesville, Ohio, will install some new woodworking machinery.

The Pennsylvania Railroad at Cleveland, O., will require mechanical equipment for its new $3,000,000 docks.

The Rumly Company, La Porte, Ind., has let contract for the construction of a large warehouse in Billings, Mont.

The Michigan Sulphite Fiber Company, Port Huron, Mich., is erecting a new plant for the manufacture of paper.

The Globe-Wernicke Company is to erect a large addition to its plant in Norwood, Ohio, abandoning its present plant in Cincinnati, Ohio.

The O. M. Edwards Company, Syracuse, N. Y., is planning an addition to its factory where it makes padlocks and parlor-car specialties.

Tri City Automatic Home Telephone Company, Rock Island, Ill., has been incorporated. Incorporators, J. A. Smith, B. Barth and M. Boelens.

The A. Bauer Construction Company will erect a seven-story building at Erie and Franklin avenues, Chicago, Ill. V. W. Behel, architect.

H. W. Butterworth & Son have let contract for a boiler and engine house to be erected at Gaul and Gordon streets, Philadelphia, Penn., to cost $5000.

L. & J. G. Stickley Company, Fayetteville, N. Y., has purchased a tract of land there, to build a new shop for high-grade furniture manufacturing.

The Scott-Lugers Lumber Company, Holland, Mich., is to erect a new planing mill, 60x144 feet, which will be equipped with modern machinery.

The Toledo Railway and Light Company has taken out two permits for the erection of two new power plants to be constructed of brick and steel.

The Phœnix Ice Machine Company, of Center street, Cleveland, Ohio, will build a factory in the near future and will need additional equipment.

O. Nelson and A. Boech, of Beloit, Wis., are planning extensive improvements to the electric plant at North Freedom, Wis., which they have purchased.

SOUTHERN STATES

The Baltimore Enameling and Novelty Company, Baltimore, Md., is to make additions to its power plants.

The Ohio Valley Electric Railway Company has begun the work of erecting a large addition to its Kenora (Ken.) power house.

Fire did damage amounting to about $100,000 to the plant of the D. R. Russell Distilling Company and the candy factory of Rudolph & Bauer, at Louisville, Ky.

A shoe factory to be known as the Carolina-Georgia Manufacturing Company is to be constructed in Augusta, Ga. The venture is reported to be a $350,000 proposition.

WEST OF THE MISSISSIPPI

The True Fissure Mining Company, near Jarbidge, Nev., will install a new power plant.

John Nicholl and J. R. Nystrom, Richmond, Cal., plan to install new machinery for gas-well drilling.

Bonds for $10,000 have been voted at Browns Valley, Minn., for the purpose of building an electric-light plant.

The Union Oil Well Supply Company, Los Angeles, Cal., plans to erect a new shop building at Brea, near Whittier, Cal.

The Twin City Telephone Company, Pasco, Wash., plans for the erection of a new plant. About $30,000 will be expended.

The Gallup (N. M.) Oil Company will install new machinery for oil drilling. C. N. Cotton is head of this company.

The Pacific Telephone and Telegraph Company, San Francisco, Cal., is planning for the erection of a new plant at Fresno, Cal.

The city of Portland, Ore., is having plans prepared for a new boiler plant on Hancock street. E. F. Lawrence, architect, Portland.

The California National Supply Company, Los Angeles, Cal., oil-well specialties, will build a new shop at Brea, near Whittier, Cal.

The E. K. Wood Lumber Company, Hoquiam, Wash., will make improvements in its plant and install new machinery and engine equipment.

Blythe, Cal., plans for the erection of a large power plant, for lighting and power work, near Bullshead, vicinity of Fort Mojave, Ariz.

The Kittitas Railway and Power Company, Cle Elum, Wash., is planning for the erection of a steam-generating power plant at Roslyn, Wash.

The Mt. Hood Railway and Power Company, Portland, Ore., has had plans prepared for a new generating plant to be erected on Williams avenue.

Mining

The Mono mine, near Yreka, Cal., will install a five-stamp mill.

The San Luis mine, Graniteville district, Cal., will build a 10-stamp mill.

M. E. Moore, Edwardsburg, Idaho, will build a new stamp mill and cyanide plant.

The Estrella Polar mine, Lower California, will increase the capacity of its milling plant.

The Contra Estaca mine, Durango, Mex., is planning for the erection of a cyanide plant.

The Fuerte mine, Guanacevi district, Durango, Mex., plans the erection of a milling plant.

The Mountain View mine, near Grangerville, Ida., contemplates the erection of a stamp mill.

The Ohana Mining Company, near Blackhorse, Nev., plans for the erection of a 10-stamp mill.

The Tip-Top mine, Buena Vista, near Bishop, Cal., contemplates the erection of a milling plant.

The Boston Ely mine, Ely, Nev., is planning to install new pumping machinery for mines operation.

The McKinley mine, near Republic, Wash., is planning for the erection of a 100-ton concentrating plant.

The Wennersten mine, near Silver City, Ida., contemplates the erection of a new mill in the near future.

The Remedios mines, Minas Neuvas district, Chihuahua, Mex., plans for the erection of a cyanide plant.

The Alamos Mining and Exploration Company, Plomosas, Sonora, Mex., plans for the erection of a new mill.

The Iowa Mining and Milling Company, near Victor, Colo., is said to be planning the erection of a new mill.

The La Gloria Mining Company, near Mazatlan, Sinaloa, Mex., plans for the erection of a 25-ton milling plant.

The Towner-Lovell mines, Whetstone mountain district, near Tombstone, Ariz., plan for the erection of a new mill.

The Gold Circle Crown Mining Company, operating in Elko county, Nev., plans for the erection of a stamp mill.

J. P. Jacobson, Chemehuevis valley, Mohave county, Ariz., contemplates the erection of a milling plant in the near future.

Porter & Son, Denver, Colo., contemplate the erection of a cyanide plant in the Meadow Lake district, near Truckee, Nev.

The Mizpah Copper Mining Company, Hoodoo district, near Spokane, Wash., plans for the erection of a concentrating plant.

The Phœnix Lake Mining Company, near Confidence, Tuolumne county, Cal., contemplates the erection of a new milling plant.

Lewis D. Gordon, operating the Cerro Gordo mine, Inyo county, Cal., plans for the erection of a smelting plant near Bakersfield, Cal.

The Kirk Mining and Milling Company, Denver, Colo., plans for the erection of a large concentrating mill near Georgetown, Colo.

The London Exploration Company, operating the McKinley Lake mine, Prince William Sound, Alaska, contemplates the erection of a large stamp mill.

The Skipper Gold Mining and Milling Company, near Magalia, Cal., contemplates the building of a new mill. C. L. Browning is head of this company.

The Santa Ana Anexas Mining Company, Pachuca, Mex., is planning to install new electric operating machinery in place of its present steam power plant.

The Humboldt Quartz and Placer Mining Company, Spokane, Wash., recently organized, is planning to expend $50,000 for new machinery for its property near Marshall Lake, Idaho.

Coe Hill Coal Company, Nelsonville, Ohio, has been incorporated to mine and sell coal. W. H. Bennett, P. D. Hill, H. A. Simes, C. J. Sanders and Hugh Mallen are the incorporators.

The Sprague-Keasbey Asbestos and Magnesia Mining Company, Auburn, Cal., is planning to install a plant for mining asbestos in this territory. Modern equipment will be installed.

The Sierra Gorda mine, Moctezuma district, Sonora, Mex., contemplates the erection of a smelting plant. The United Mexican Mines Company, Kansas City, Mo., operates this property.

The Shelby Coal Mining Company, Warren, Ohio, has been incorporated with a capital stock of $50,000. Incorporators, J. H. Price, W. A. Gebhard, J. M. Aubel, F. H. Whitehouse and W. A. Pierce.

The Hocking Black Coal Company, Columbus, Ohio, has been incorporated with a capital stock of $10,000, to mine and sell coal. Edward A. Hoen, Frank H. Gale, O. L. Aumiller, George A. Fairbanks and B. E. Dille, incorporators.

Business Items

The Prentiss Tool and Supply Company has moved its office and salesroom from 115 Liberty street to the Singer building, 149 Broadway, New York City.

The Fosdick Machine Tool Company, Cincinnati, Ohio, has begun the erection of an addition to its plant, which will greatly increase its manufacturing facilities.

Forthcoming Meetings

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Welles tools. Welles Caliper Co., Milwaukee, Wis.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Special machinery designed and built to order; tools, jigs, fixtures, sheet metal tools and stampings. Frank J. Dyett Co., Ilion, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Specialties to manufacture; uptodate brass foundry and machine shop; automatic machinery, etc. Edward Schroeder Lamp Works, Jersey City, N. J.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Manufacturers, sale or royalty, expansion mandrel that can be made cheaper and will answer its purpose better than any on the market. "A 1," Box 225, AMER. MACHINIST.

Competent mechanical engineer, N. Y. City, designs special and automatic machines and tools for all kinds of duplicate work; highest references. Box 852, AMER. MACHINIST.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Wanted—Party or parties to buy the Canadian manufacturing right of one of the most uptodate machines in the way of a store fixture that was ever invented, now being manufactured and sold in the United States. Box 198, AMERICAN MACHINIST.

Peck's "Sure" center finder goes on tailstock center of lathe and finds drills and countersinks a center in work held and revolving in lathe chuck; made in four sizes, drill diameters ¼, 5/64, 1/16 and 3/64 inches; by mail postpaid on receipt of 65c. each size. W. A. Peck, 141 Brewery St., New Haven, Conn.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Pierce Manufacturing Company, Woonsocket, R. I.

Wanted—The following second hand machine tools, same must be in good condition, but old fashioned designs will be considered: One lathe to swing drums about 5 feet diameter, 6 feet long; one lathe about 18 inch center by 20-foot bed; one lathe about 12-inch center by 20-foot bed; one planer about 40x40 inches by 12 feet; one radial drill 4 feet to 5 feet box bed. Please state full particulars, giving names of makers and prices. Box 239, AMERICAN MACHINIST.

The advertiser has sale for, and wants to contract for, a number of medium heavy machines, a patented specialty, and wishes to get in communication with some uptodate country shop where they have not already too many irons in the fire, and where the owners would be satisfied with a reasonable profit; these are a fairly good class of machines and require good mechanical work on them; there is enough work to keep a small shop going on these machines; we might consider renting an uptodate small machine shop, with the privilege of purchase later; would prefer a small country shop with from ten to twenty-five hands, and where electricity is available. Address Box 356, Bridgeport, Conn.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—First class general foreman for a works manufacturing street railway special work. Box 218, AMERICAN MACHINIST.

Wanted—First class metallurgist; one especially posted on manganese steel castings, and willing to go to Canada. Box 217, AM. MA.

Wanted—One tool draftsman, one drop forge die sinker, six toolmakers; only first class men need apply; state fully, experience and salary expected. Apply Ross Rifle Co., Quebec, Canada.

Wanted—Superintendent for machine shops, boiler shop, foundry and pattern shop manufacturing high grade engines and boilers; must be familiar with uptodate methods; state age, experience and salary expected. Box 195, AMERICAN MACHINIST.

Wanted—A practical mechanical partner with ten thousand dollars capital to invest in a prosperous well established business; no incumbrance; requirements: the production of interchangeable tool parts and marine motors. Apply P. O. Box 682, Montreal, Canada.

CONNECTICUT

Wanted—Superintendent for uptodate shop, 100 men; must be experienced in manufacture of drills, taps, bits or kindred lines; thorough knowledge of hardening and tempering essential; must have tact, hustle and be abreast of the times. Box 223, AM. MACH.

ILLINOIS

Wanted—Salesman to sell a leading brand of high speed and carbon steels; one who has a thorough working knowledge of such steels and is able to demonstrate them, is required; a man familiar with the Northern States of the Middle West is preferred. Write, giving particulars of age, salary expected, experience, etc., to Box 157, AMERICAN MACHINIST.

INDIANA

Wanted—Foreman and several first class toolmakers for tool room, making punching and forming dies and jigs and fixtures for gas engine work. Apply by letter, giving complete information as to experience, references, etc. Box 219, AMERICAN MACHINIST.

Wanted—A few skilled toolmakers by a well established manufacturing firm, located in Indiana; applicants must be of high character and enterprising in their work; state character of work best skilled in, age, experience and give references. Box 170, AM. MACH.

Wanted—We employ Cleveland and Brown & Sharpe automatic turret forming machines, Potter & Johnston and Jones & Lamson turret lathe, also automatic gear cutting machines; we want a man skilled in the operation of some or all of the above, who is thoroughly qualified to operate and superintend to best advantage. Address, stating age, experience and give references. Link-Belt Company, Indianapolis, Ind.

IOWA

Wanted—Draftsmen experienced on steel and wood car construction; steady work for the right men. Box 236, AMER. MACHINIST.

Wanted—Machine shop foreman; must be competent in building pneumatic machines; state age, experience, salary wanted, whether married, etc. Box 155, AMER. MACHINIST.

Wanted—General superintendent, capable of taking complete charge of thriving and fast growing factory making general line of

steel stampings; location in good mid-western city; runs about thirty punch presses, with full supplemental equipment, employs seventy operatives; must be first class executive, good disciplinarian, able to handle labor, and to turn out the work; only thoroughly equipped and experienced man need apply; place demands a good man and will pay for him, but wants full value received; no beginners or failures wanted, but the chance of a lifetime for the right man; state fully and clearly your qualifications, experience, age and salary desired; all will be held strictly confidential. Address "X," Box 50, AM. MA.

MASSACHUSETTS

Experienced man, case-hardening work. Address, with details, Boston Gear Works, Norfolk Downs, Mass.

Inspector on machinery parts; one experienced on gears preferred. Boston Gear Works, Norfolk Downs, Mass.

Draftsman for printing machinery; good position for man of ability and experience as designer. Address Box 206, AMER. MACH.

Wanted—A skillful and experienced erector to take charge of the erection of refined though heavy apparatus. Box 243, AM. MA.

WANTED—First class car draftsmen, preferably with wood and steel car experience; none but first class men need apply. Osgood Bradley Car Company, Worcester, Mass.

Wanted—Cost clerk for manufacturing concern, with actual experience in cost finding of quantity production parts; man with technical knowledge preferred; give detailed experience, places and periods of employment, references, age and salary expected. Address "Clerk," Box 1574, Springfield, Mass.

Wanted—One or two strictly first class machinists; men with experience in installing printing machines or similar automatic machinery; must be able to furnish first class references as to ability and character and willing to go anywhere in the States or Canada for installations; to such men we can offer good, steady positions and good pay with a chance for promotion. Apply, "C. S. P.," AMERICAN MACHINIST.

MICHIGAN

Wanted—First class man to take charge of automatic department using multiple spindle machines on all kinds of automobile parts and small accurate work; must be uptodate in the latest designs of tools and able to produce quality and quantity; give references and wages expected. Box 240, AMER. MACH.

NEW JERSEY

First class die maker wanted; none other need apply. Crocker-Wheeler Company, Ampere, N. J., on D. L. & W. RR.

Working foreman to take charge of tool room for the manufacture of metal specialties; only thoroughly competent men need apply; state salary and former experience. J. Chein & Co., 310 Passaic Ave., Harrison, N. J.

Wanted—Toolmakers, Jones & Lamson and Gisholt operators, and general machine tool hands; good pay, steady employment; mail application, giving wages at last place. Crane Motor Car Company, 96 West Seventh Street, Bayonne, N. J.

Draftsman wanted for city in New Jersey, ten miles from New York; one familiar with drawings for fine tool work; also draftsman conversant with tool layout for Brown & Sharpe automatic screw machine work. Box 230, AMERICAN MACHINIST.

Tool and jig designer wanted; must be a thorough practical shop man, capable of making sketches and drawings; permanent position for the right man; location near New York City in machine works employing 2000 hands. Box 238, AMERICAN MACHINIST.

NEW YORK

Agent wanted to sell old line of metal stamping presses. Box 233, AMER. MACH.

Salesman to sell tools and supplies in New York and vicinity. Box 224, AMER. MACH.

Wanted—Time clerk and cost keeper; must be quick and accurate; good opportunity for advancement if competent. Box 205, AM. MA.

Machinist—A first class toolmaker, competent to manufacture a small metal device; very accurate work required. Box 222, AM. M.

Wanted—Good detailer and tracer; must be quick and accurate; state references, experience and salary expected. Box 203, AM. M.

Wanted—First class layoutman and inspector; must be competent, quick and reliable; good opportunity for right party; state experience and wages expected. Address Box 202, AMERICAN MACHINIST.

Foreman Inspector Wanted—Foreman inspector on high grade automobile parts; must keep his department well organized and execute work in intelligent manner. Write, giving experience, references, etc. F.I.A.T., Poughkeepsie, N. Y.

Wanted—Experienced man to take charge of department making art metal work elevator cars and enclosures; must be capable of estimating costs and doing some designing; state age, experience and if possible send copies of references. Box 242, AM. MACH.

Wanted—Several first class bench hands on machine tools and special machinery, also first class horizontal boring machine operator; permanent position and good opportunity for advancement if competent. Box 204, AMERICAN MACHINIST.

Wanted—Machinery salesman, live and energetic, with theoretical and practical experience in gear cutting, for selling high grade, well known line of modern gear cutting machines; first class opportunity for capable hustler; state age, salary desired, former experience and territory covered; only men with thorough experience in gear cutting line will be considered. "S. G.," AMER. MACHINIST.

OHIO

Designer, experienced in dies, tools and automatic machinery, wants position. Box 220, AMERICAN MACHINIST.

Wanted—First class draftsman familiar with designing planers and boring mills. The Cincinnati Planer Co., Cincinnati, O.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—Vise hands and erectors. Eclipse (Motor) Truck Co., Franklin, Penn.

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 208, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WASHINGTON

Wanted—An assistant foreman, young and uptodate, who understands sawmill and engine work, to have charge of floor and bench hands; from 15 to 30 men under him; good job for the right man. Address, Sumner Iron Works, Everett, Wash.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

ILLINOIS

Englishman employed on the road by firm of Chicago jobbers—mill supplies—seeks similar connection with firm manufacturing representative line; technical education; excellent sales record. Box 234, AMERICAN MACHINIST, 122 So. Michigan Blvd., Chicago, Ill.

INDIANA

A-1 all-around mechanic, toolmaker and tool designer, college graduate, executive and competent, inventive ability, wants position as foreman, master mechanic or superintendent; age 35; at present chief tool designer. Box 245, AMERICAN MACHINIST.

MASSACHUSETTS

Practical mechanic, expert designer of tools and special machinery, with extensive experience and executive ability, desires responsible position. Box 214, AMERICAN MACHINIST.

NEW JERSEY

Experienced engineer and designer, expert on shop practice, cost system, etc., wishes responsible position with first class concern. Box 171, AMERICAN MACHINIST.

Efficiency engineer, conversant with theory of uptodate efficiency methods and their practical application, in responsible position, desires change. Box 152, AMER. MACHINIST.

Draftsman, experienced on the design, erection and operation of suction gas producers and gas engines, from 6 to 150 horsepower, desires position; graduate in mechanical-electrical engineering. Box 158, AMER. MACH.

NEW YORK

First class mechanical engineer, with broad experience in designing, manufacturing and erection, wants position. Box 197, AM. MA.

Designer, 30, ten years' experience on special machinery tools and fixtures, also engineering, would like position in New York City. Box 232, AMERICAN MACHINIST.

Successful production engineer, age 35, five years in present position; can reduce cost of medium and light manufacturing; salary, $3000. Box 237, AMERICAN MACHINIST.

Superintendent and manager wants to meet firm who are in need of a live, progressive man who can introduce business; distance no object. Box 227, AMERICAN MACHINIST.

Technical graduate, with some years' experience in drafting, office work and construction work in industrial plant and power plant installations, desires to make a change. Box 229, AMERICAN MACHINIST.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Draftsman (36), executive, uptodate, seventeen years' shop and drafting room experience, designing and constructing special and automatic machinery, tools, fixtures, etc., open for responsible position where ability is recognized. Box 241, AMERICAN MACHINIST.

Experimental man and designer, capable of perfecting mechanical devices or establishing manufacturing business; executive with initiative that counts; experienced in all classes of tool and die work for manufacture of interchangeable parts, open for employment in New York or vicinity after September. Box 235, AMERICAN MACHINIST.

OHIO

Assistant superintendent desires to change to higher class proposition; 17 years' experience (executive) small to medium-size accurate work, thoroughly experienced on costs, systematizing and designing of tools; at present over 600 employees. Box 199, AM. MA.

PENNSYLVANIA

Wanted—A position as a designer and draftsman; five years' experience in automobile gas engines, jig and tool work; U. S. Naval Academy graduate. Box 231, AM. M.

Superintendent, specialist in uptodate production methods and cost reduction; over 19 years' active and practical experience in machine shop, engineering office, in plants making interchangeable machinery; married; 35 years; best of references. Box 228, AM. MA.

Mechanical expert, 20 years' experience, wishes engagement with manufacturer, building light or medium interchangeable machinery; shopman, designer and estimator; specialist on labor-saving tools; highest reference. Address "Expert," General Delivery, Wilkes-Barre, Penn.

RHODE ISLAND

Chief draftsman, assistant superintendent, wants a bigger and better job; inventive ability, a practical tool designer, a top notcher on intensive production and an able handler of men; at present employed in a plant of 600 men manufacturing several lines of medium weight machinery; 15 years' experience. Write for more particulars Box 244, AM. MA.

WEST VIRGINIA

Layer out, with 10 years' experience on heavy machinery, automobile work, gun work and marine work, with technical as well as practical training, wants position. Box 221, AMERICAN MACHINIST.

WISCONSIN

Designer and engineer, graduate mechanical engineer, age 34, expert on inventing and developing medium weight, automatic, also fine machinery, typewriters, adding machines, etc., exceptionally capable and successful on practical design of new machinery on a manufacturing basis; will consider similar position. Box 190, AMERICAN MACHINIST.

FOR SALE

New variable speed transmission; no racks, pinions or cones; works with a flat belt; would like to talk business with firm or individual with view to putting it on the market; there's a demand for such a device and a ready market. Box 226, AMER. MACH.

Completely equipped bleachery and sheet and pillow case factory, one hour from New York, plant ready to start, machinery adaptable to establishment of dye works and light manufacturing; small investment necessary. Inquire D. Kornblueh, 140 Nassau St., New York City.

Talks With Our Readers

By The Sales Manager

Have you ever noticed that in the famous Greek statue of the Discus Thrower the athlete stands with his right foot forward, ready to hurl the discus?

For centuries the Greeks had thrown it this way—it was a custom, a tradition of their favorite national sport.

No one had ever stopped to think whether or not there was a better way of doing it.

But, in the 20th century—when discus throwing was more than 2000 years old—Martin Sheridan, the American athlete, went to Greece for the Olympian Games and entered the discus event for about the first time in his life.

He grasped the missile and threw it in the natural way, with his left foot forward, and in one throw smashed not only the ancient Greek custom but also the world's record.

In this little tale there are several morals.

The men who have accomplished things and gotten ahead of their fellows are nearly always the ones who have had the nerve and the brains to break with old traditions and customs.

In these modern times there have arisen newer, better methods of doing things—in the machine shop as elsewhere.

And the man who puts his best foot forward, no matter what custom has decreed, is the man who will make new records and get farther ahead in his profession.

That most of you realize this is proved by the fact that you—the men responsible for results in machine shops—nowadays read the advertisements in your technical paper.

You know that the newer, better ways to do the old things are advertised—and you follow those advertisements conscientiously, and profit thereby.

You who read the Selling Section of the AMERICAN MACHINIST each week are the man who is putting his best foot forward in the double-quick march of Progress.

* * *

Only reliable products can be continuously advertised.

Making Gun Frames and Other Parts

By Ethan Viall*

The principal machining operations through which repeating-shotgun frames or receivers are put in a large factory.

Profiling some of the parts and method of holding pieces to be formed in a miller vise.

The way the proper radius is secured on the ends of breech blocks.

The first shop operation on repeating-shotgun frames or receivers, as routed through by the Union Arms Company, Toledo, Ohio, is to grind the sides on a Pratt & Whitney vertical surface grinder, as shown in Fig. 1, the receivers being held four at a time on an electrical chuck. After being ground, the receivers are placed on a demagnetizer, shown in Fig. 2, in order to remove any magnetism in the pieces that may have been caused by the magnetic chuck of the grinder, which would be undesirable in subsequent operations.

As soon as the pieces have been demagnetized they are sent to the milling department, where the top of the frame is surfaced off with a formed cutter, which rounds the edges and leaves a rib in the middle, the frame being held in a special vise, as shown in Fig. 3.

Now using the two ground sides and the top just milled to locate by, the receivers are placed on and between parallels in a miller vise and the bottom accurately rounded off with a formed cutter, as in Fig. 4, then they are put into an upright drill jig, Fig. 5, and the holes for the barrel and the magazine are drilled out ready for reaming and threading.

*Associate editor.

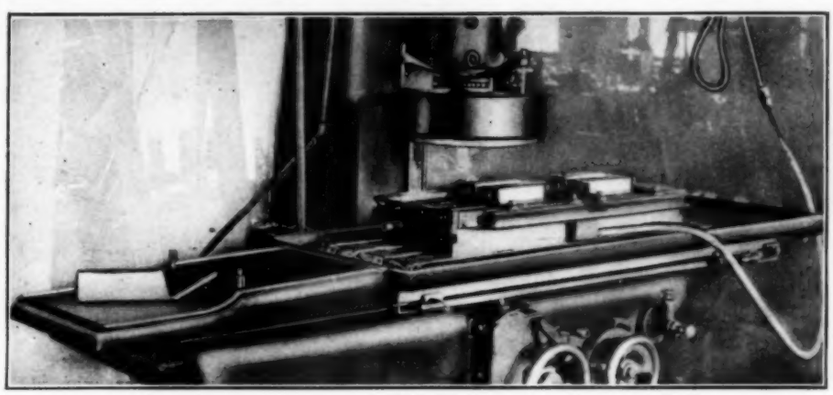


FIG. 1. GRINDING SIDES OF REPEATING-SHOTGUN FRAMES

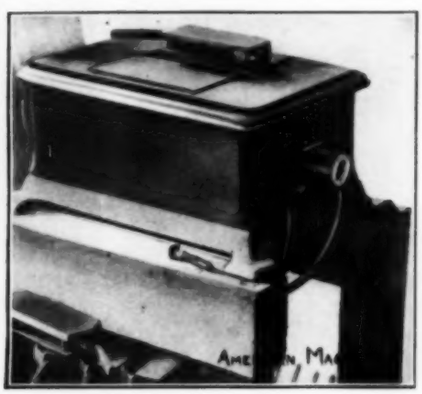


FIG. 2. THE DEMAGNETIZER

THREADING THE BARREL HOLE

The threading of the barrel hole is done in a turret lathe, the receiver being held in a special box chuck, Fig. 6, and the hole bored, reamed, threaded with the special threading device and then sized with a tap. The special device used for threading is shown in operation in Fig. 7.

A stop on the bar carrying the cutter head prevents it from dropping down too far and the cutting tool is fed down by turning the ball crank with the left hand while the right operates the lever. Bringing the cutter head down as far as it will go causes a half nut to mesh with a lead screw and feeds the cutter head forward, and lifting the cutter head by means of the hand lever disengages the half nut so that the cutter may be brought back for another cut. After the thread has been roughed out in this way close to the final size, it is finished with a sizing tap, as stated before.

The inside of the receiver is next milled out, as shown in Fig. 8, and then the cartridge slot in the side is cut out, as in Fig. 9.

The various holes are next drilled in a six-spindle driller, Fig. 10, the receiver being held in a jig as shown.

SLOTTING THE INSIDE OF THE RECEIVER

Milling out the inside with a circular cutter leaves round corners, which have to be machined out. This is done in a small slotter, Fig. 11, the receiver being held in the regular slotter vise.

Grooves on the inside for some of the moving parts to work in are cut with an

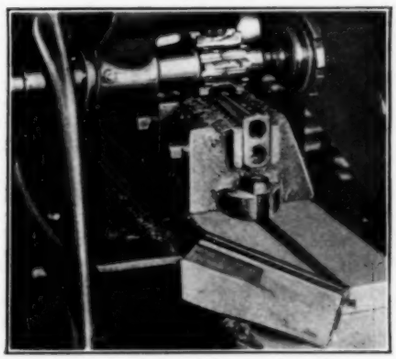


FIG. 3. MILLING THE TOP

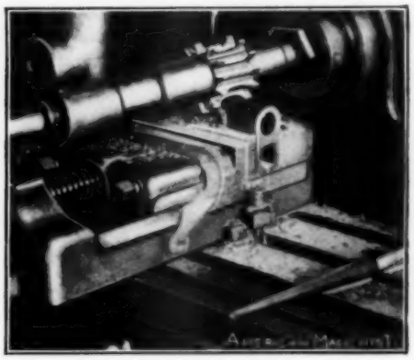


FIG. 4. MILLING THE BOTTOM

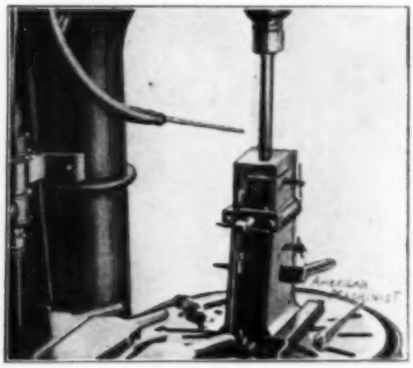


FIG. 5. DRILLING OUT THE BARREL AND MAGAZINE HOLES

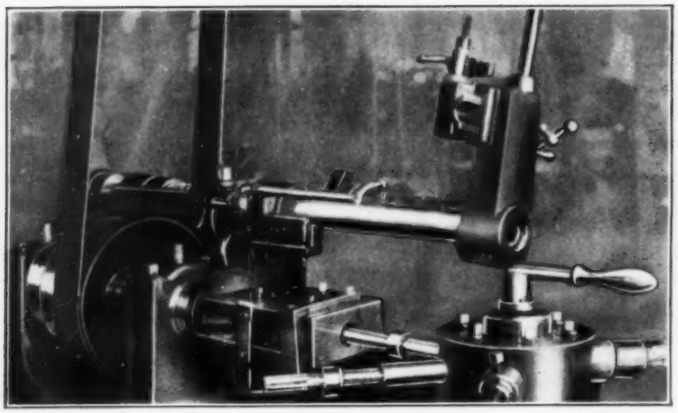


FIG. 6. TURRET LATHE EQUIPPED FOR THREADING BARREL HOLE

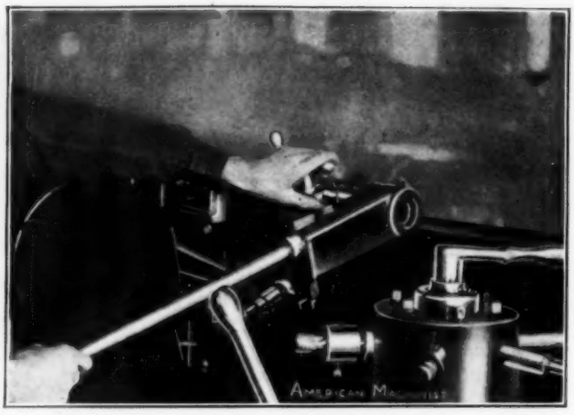


FIG. 7. THE THREAD-CUTTING APPARATUS

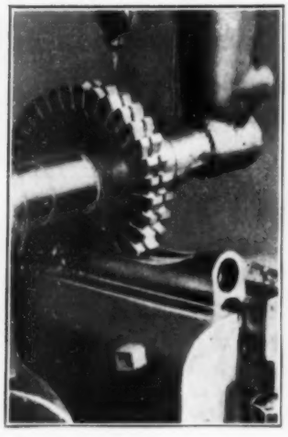


FIG. 8. MILLING INSIDE OF FRAME

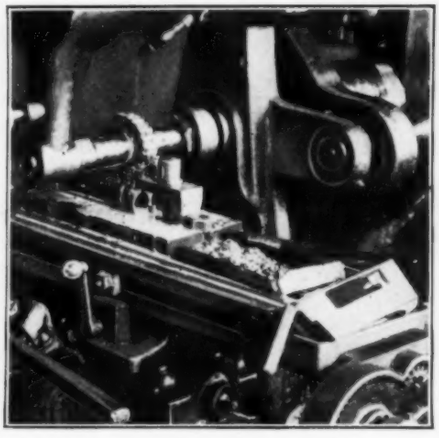


FIG. 9. MILLING CARTRIDGE SLOT IN SIDE

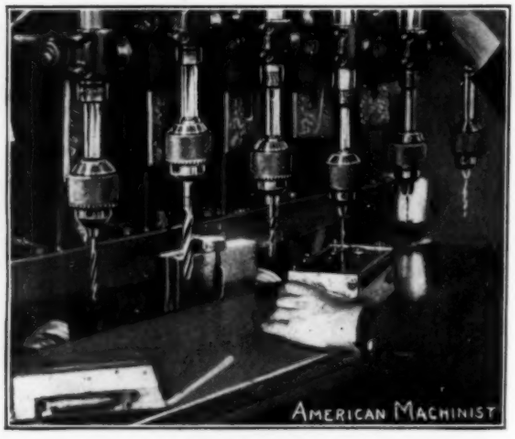


FIG. 10. DRILLING THE HOLES IN A MULTIPLE-SPINDLE DRILLER

end mill, Fig. 12, while the receiver is held in a special jig.

After the trigger guards have been fitted, the two tangs for holding the stock are milled off on the sides and the shoulders, against which the end of the stock butts are finished, as shown in Fig. 13.

Breech blocks for double-barrel shotguns are slotted out for the side rods on a profiling machine, shown in Fig. 14, the profiling guide plate being shown just back of the breech block in the jig.

Trigger guards are also finished on the inside, on a regular profiling machine, using a master form as a guide.

FALSE JAWS FOR THE MILLER VISE

A number of formed cutters and sets of false jaws used in the miller vise for shaping various gun parts are shown in Fig. 15, and in Fig. 16 is shown the method of turning the ends of repeating-

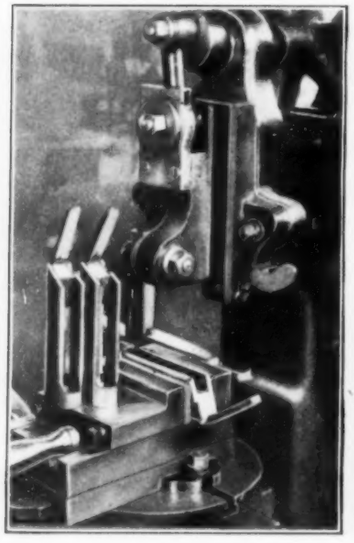


FIG. 11. SLOTTING OUT THE INSIDE

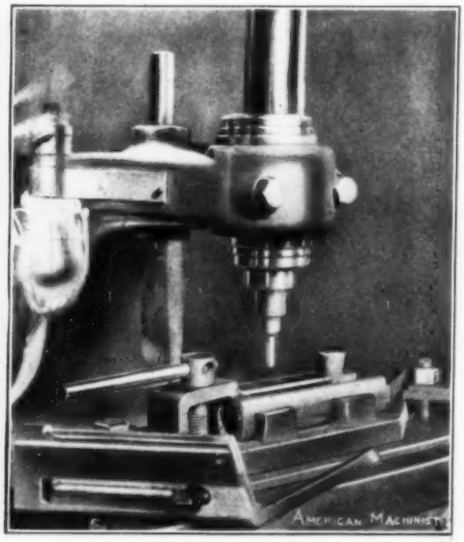


FIG. 12. FINISHING INSIDE WITH AN END MILL

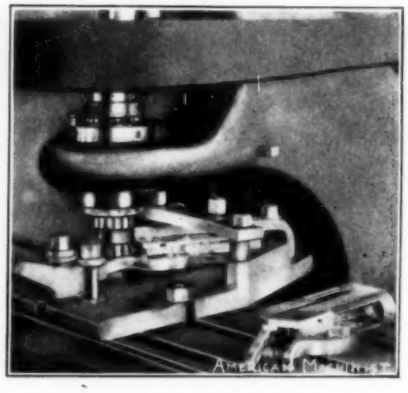


FIG. 13. MILLING SIDE OF TANG

shotgun blocks, they being clamped to a face-plate jig, four at a time, the correct position of the blocks being insured by pins set near the center of the face plate over which the blocks are placed and then butted against other pins set near the

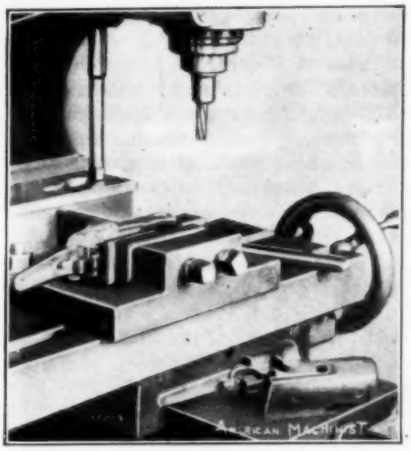


FIG. 14. PROFILING SIDES OF DOUBLE-BARREL BREECH BLOCKS

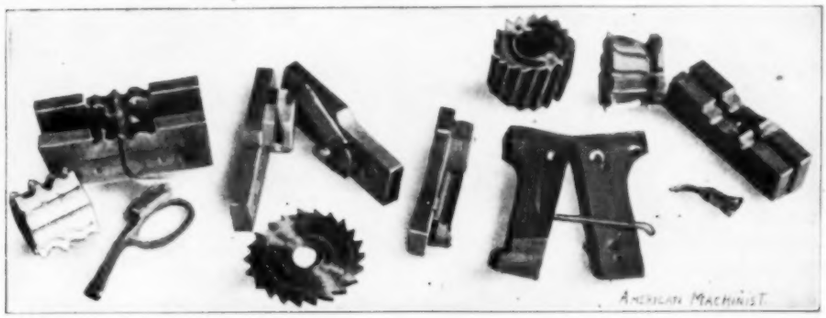


FIG. 15. FALSE VISE JAWS AND CUTTERS FOR MILLING VARIOUS GUN PARTS

edge of the plate. The job is then finished by running the lathe tool across the ends, which gives them the correct radius.

Training Men for Other Shops

BY JOHN R. GODFREY

It doesn't take a very old man to remember when all business was done on the "stick-em-if-you-can" plan and the "hoss trade" in David Harum was typical of the old idea of business in general. Unfortunately too much of this idea still remains in some lines, and the machine builders can congratulate themselves on being less tainted than many of the other lines.

When we had to buy a lathe or anything else, we expected to get stuck unless we found a maker who needed money so much worse than he did the lathe that we could get it for less than cost. We couldn't possibly see how a sale could take place that was beneficial to both parties. Fortunately this attitude is giving place to a more rational idea, after having passed, or passing, through the stage where the seller was held up on every pretext.

Of course, it sounds rather preachy to hear a man say that the more we give the more we get, and we immediately assume an air of superior intelligence and begin hunting to see if his wings are sprouting, but there is more hard-headed practical truth in it than appears on the surface.

One of my good friends has just turned out two first-class apprentices, and is being laughed at by some of his more practical (?) business friends, because they have left him and are going to other shops. "We don't train boys for our competitors" sounds like real modern business—perhaps. But is it?

Some shops seem to take pains to train their boys so as to be useful only in their shops and with their methods. True, they can learn other ways if they leave, but they are not real machinists until they do, and the boys soon find it out. And does anyone suppose they cherish any additional loving remembrances of the old shop on that account?

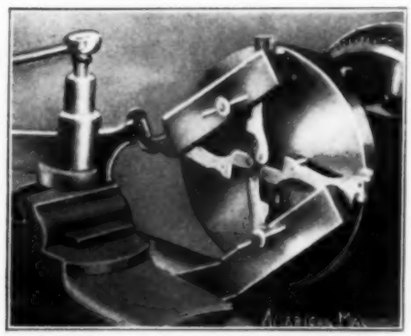


FIG. 16. TURNING ENDS OF BREECH BLOCKS

THE BEST KIND OF ADVANCE AGENTS

This friend of mine has reached the stage where he is convinced that every good mechanic he makes in his shop helps him in the long run, even if the boy leaves him for one reason or another the minute he gets through. For, he reasons: "Every good mechanic adds so much to the world's productiveness, and I'll get a share of the general good even if I don't get it all." And there is every chance that he will get direct returns in a very few years, although that isn't the reason for his belief.

Every boy and man who leaves a shop where good work is done and where he has been treated fairly, and who leaves with a good taste in his mouth and a kindly feeling in his heart, is the best kind of an advance agent.

This is not a new idea, for Amos Whitney had the notion years ago, much to the disturbing of the tranquillity of his partner's peace of mind. For he went even further, and had the nerve to help new concerns pick good men from his own shop. Many a time he sent out one of his best foremen in response to a request for a man from a new concern in the West. Everyone thought he was foolish to train men for the other fellow.

And probably few connected his policy of sending good men whenever they were asked for, with the enormous sales of Pratt & Whitney tools in all the new shops in the West, but Amos Whitney knew all about it.

ONE RESULT OF GOOD TREATMENT

Every man appreciates being recommended to a good job, and when you couple this with his knowledge that you are building machines that are first-class in every way, you can count on his "rooting" for your machines wherever there is an opportunity. And recommendations of this kind help more than many realize in placing machines in good shops.

I recall two cases where orders came in without solicitation from Punkville and Doddtown for machines that totaled up about $3200.

One, it was found, came through a man who at one time ran the small engine in the old shop, and the other through a boy who had left before his time was up. Both knew the machines were well built, and both had a kindly feeling for the shop where they had been well treated.

I know other shops where the men who leave carry away an ingrowing grouch, and when they have an opportunity to recommend machines, it is pretty apt to be the other fellow's. After all, it looks as though the returns for good treatment might not be as far in the future as some seem to think.

Of course, in the East, labor is very cheap; and therefore labor-saving devices are not so much appreciated as they are in this country. On the other hand, metal working is increasing, because they are opening mines. They are now producing a very high grade of iron over in China and Australia, and to some extent in British India, and the development of steel making is going on very rapidly. As that continues to increase, the trade in improved tools for handling work will receive a general impetus.

The Turin International Exposition

By I. W. Chubb

In comparison with the exhibits at Brussels last year, little advance in machine tools is visible.

However, there is one striking feature; namely, the definite entry of Italy into the machine-tool field as a manufacturing nation.

Details of the more notable machine tools exhibited.

The Turin Exhibition, open until an indefinite date in November, forms part of an effort to commemorate the fiftieth anniversary of the independence and reconstruction of modern Italy. After 50 years as a corporate nation, Italy, imperfect, no doubt, has advanced to a recognized position as one of the chief civilizing powers of Europe. The International Exhibition of Industries, at Turin, is intended to demonstrate to the world the economic and industrial progress of the Italian kingdom.

Narrowing down at once to the engineering features, it may be said that but little advance is visible on the exhibits at Brussels last year. Of machine tools this is specially true. There is, however, one striking feature, namely, the definite entry of Italy as a manufacturer into the machine-tool field. Of course, to an extent, these machines have been made in Italy for some years. I may perhaps refer to articles on the Milan Exhibition appearing in Volume 29, in which I dealt very briefly with the matter.

The site is on both banks of the river Po, with the Alps in the distance. The Valentine park, on one side of the river, has already been the site of exhibitions in 1884 and 1898, and the sham-medieval castle, etc., built as an attraction to the former of these exhibitions, remains, with artisans at work in their old costumes. The Valentine castle, dating back to the middle of the seventeenth century, and now in part used as a polytechnic, is included.

It was, I believe, at first proposed to hold an exhibition to illustrate the advance in printing and allied arts during the past 50 years, and out of this proposal the present organization was evolved.

Great Britain's section is very nearly self-contained, providing its own power and light, with nearly all its exhibits under one roof. On the other hand German machinery dominates the international-machinery hall and France has a number of small pavilions scattered about the grounds, together with a large miscellaneous engineering section which forms part of the electricity hall.

British Exhibit Rivals German

Great Britain now places the arrangement and organization of British sections at international exhibitions in the hands of a special branch of the Board of Trade. There can be no doubt as to the general advantage to the country. In Great Britain exhibitions, whether really international in character or merely local, are in somewhat bad odor, that is, outside the general public. It has been found that the chief and sometimes only advantage is that which goes into the pockets of the exhibition promoters. This dissatisfaction has in fact recently led to the formation of the Machine Tool and Engineering Association, whose sole object, at the commencement at any rate, was to regulate exhibitions from the point of view of machine-tool makers and factors. The association will in fact promote its own British exhibitions of machine tools, one in London every three years, possibly with alternating exhibitions in the provinces. An attempt will be made to bind members not to show at unapproved exhibitions. In this policy the new organization is simply following the lead of motor-car manufacturers and also cycle manufacturers in Great Britain. That the Board of Trade has been of real help at Brussels and Turin cannot be denied. Space and power charges have been minimized, arrangements for transportation of goods have been simplified, and every effort has been made to help and support the British exhibitor in a foreign country. The result is that, although not altogether quite representative, the British section at Turin should afford to the visitor a fair idea of Great Britain as a manufacturing country. For once at least on the continent of Europe a successful attempt has been made to rival Germany at an international show.

The British pavilion is divided into 15 sections, the chief of which are as follows: Machinery hall, land transport, chemical- and scientific-instruments court, ceramic court, textile court, food-products court, library, and Bradford tableaux. British exhibitors, large and small, number upward of 350.

The Power Exhibts

In steam engineering the Turin Exhibition has nothing distinctive. The central station, which supplies power for all sections except the British and Swiss, contains both steam and oil units, the total power shown by the plans being about 10,000 horsepower. The boilers are either Tosi or Babcock & Wilcox and the working pressure is about 190 pounds, with superheat. In the eight units, steam turbines, an ordinary compound tandem engine and Diesel-type motors are included, all coupled direct to alternators. A 4500- to 5000-horsepower Tosi steam turbine running at 1500 revolutions is, for instance, coupled direct to a 4200-horsepower, two-phase, 6400-volt, 50-cycle generator, by Ganz, of Buda-Pesth. Other engines are by Brown-Boveri, of Baden, and Sulzer Brothers, of Winterthur, with the electrical plant by Savigliano, of Turin, and others. The feature, however, of the engine side of the whole exhibition is in the number of Diesel-type engines, German, Italian, Swiss and French. These are of various sizes, a 1000-h.p., two-cycle Diesel engine, for instance, by the Sulzer firm being shown in the power house coupled to a flywheel-type alternator. Similar engines of higher power, 2000 horsepower and more, are made by the Swiss firm. Tosi, of Legnano, and Langen & Wolf, of Milan, also show Diesel engines up to 600 horsepower.

Possibly the only horizontal Diesel-type engine on view, by the Dingler firm, of Zweibrücken, is of but 30 horsepower; it will be found in the international-machinery hall, the oil costing, it is said, 0.3 to 0.44 cent per effective horsepower. The British section, although including a number of crude-oil engines, has hardly anything of Diesel character, but the Campbell company, Halifax, is understood to be showing a 35-brake horsepower, crude-oil engine, in which the charge is ignited by high compression. The reason for the special display of oil engines may be found in the lower duty. The British engines include a 25-brake horsepower, crude-oil engine, by Blackstone & Co., Ltd., Stamford, in which, by a twin device, compressed air both sprays the oil into the combustion chamber and, by an auxiliary jet, discharges oil into an ignition chamber, where it is kept alight. The flame ignites the main charge, connection between the two chambers being made by a port. For this engine some advantage over the Diesel type is claimed in reduction of compression. The chief display by British engineering firms, however, is in a suction-gas plant. In fact, the whole of the electric power and lighting of this section is derived from suction gas engines, etc., by the Campbell Gas Engine Company, Halifax, and Hornsby & Sons, Ltd., Grantham. Little need be said regarding the British gas plant, placed outside the main building, of course. The engines total about 750 horsepower, the largest unit being of 290 horsepower. With one type the gas-generator hearth is open, so that the fire

can always be inspected, while the other type has sliding fire bars. A few Italian internal-combustion engines are exhibited, but call for no special reference.

Comparatively poor in the chief mineral resources of coal and iron, Italy is a large importer of coal, 9,000,000 tons now coming into the country yearly, against 3,000,000 tons a quarter of a century ago. Mining, with a yearly output of about $15,000,000, is far more than a half in sulphur. Everybody knows that water power is largely employed, plants of 700,000 horsepower being used last year for electrical generation alone. Therefore, but for considerations of size, etc., it would be surprising that so little of hydraulic-power engineering should be visible. Almost the sole exhibit of importance is a vertical turbine of 1600 horsepower at 85 revolutions per minute, by T. Bell & Co., Kriens, Switzerland.

MACHINERY EXHIBIT AT THE TURIN INTERNATIONAL EXPOSITION

THE LOCOMOTIVES

On the heavy side of the transport section continental countries alone are represented. No American locomotives are found, and the only English engine is one which was built in 1857 by Beyer & Peacock, Manchester. With cylinders of about 400 millimeters bore by 500 millimeters stroke (15¾x20 inches), and a boiler barrel of 1225 millimeters (4 feet diameter), the locomotive weighs about 27 tons empty, and the tender another 22 tons. It is shown for its historical interest only. At about its date England might almost be said to have held a monopoly in the supply, not only of railway but of other engineering material, etc., in Italy. Different conditions account for the present position, and not necessarily any decline in English locomotive engineering. Nothing in this section calls for particular notice as much beyond recognized practice on the Continent. The best-looking engine, whether for form or finish, is undoubtedly that of the Paris, Lyons, Mediterranean Company, made in its Paris works. Their locomotive and its tender weigh about 255,200 pounds. It uses superheated steam at 350 degrees Centigrade (66 degrees Fahrenheit) the working pressure being 12 kilograms per square centimeter (175 pounds per square inch) and has four cylinders, 480-millimeter bore by 650-millimeter stroke (18⅞x21⅝ inches). To take a German example, a Schwartzkopp Prussian State Railways high-speed locomotive, by E. Brede, of Milan, has four cylinders of the same size and pressure as the Paris, Lyons, Mediterranean engine, with a boiler barrel of about 1700 millimeters (about 66½ inches) diameter, the weight of engine and tender empty being 109 English tons. As on several other locomotives, the Schmidt superheater is fitted. In the electrical section, far from the locomotive department, may be seen a single-phase, 10,000-volt locomotive, by Siemens-Schuckert, Berlin.

AUTOMOBILES

In automobiles a representative display has been collected on behalf of Great Britain by the Society of Motor Manufacturers and Traders, about a dozen firms being represented. Many of the principal Italian, French and German firms also exhibit, but in practically all cases it is impossible to inspect the mechanical-engineering features of the cars. It is generally held, however, that for mere appearance and outward finish of body work the British productions are certainly not behind the others. In cycles, including motorcycles, the British section too is, alone among the nations, completely represented, both by acces-

sories and components; but nothing stands out.

Agricultural and Textile Machinery

In agricultural and textile machinery the British exhibits are among the best. Besides the necessary engines, stationary and portable, they include various threshing machines, plowing machines, etc., and "a complete hay-harvesting machine to turn two swaths, collect four swaths into one windrow and ted and turn a windrow on to fresh ground." Several of the machines are modified to suit Italian requirements. In the French section harvesters are predominant. In the British textile-machinery department the mechanical engineer will note with interest the various methods by which alternating-current motors have been employed to drive. All the ordinary methods of supporting the motors and transmitting energy may be seen on the stand of Hacking & Co., Bury, and the British Northrop Loom Company, Ltd., Blackburn, including several clutch and chain devices, in one of which the chain runs on to a plain flanged pulley, thus giving some measure of slip. A cycle chain with leather edges is also employed for driving.

The Machine Tools

In machine tools undoubtedly the most comprehensive display is that of Germany in the international-machinery hall. The American tools are in the Italian section of this hall, on the stands of two agents, Fenwick Frères and A. Schütte. Nothing new to readers of this journal is presented and, while the two collections are large and exhibit a wide range of medium-size machines, no useful purpose would be served by providing a mere list of firms. The French section has but two or three stands of special work-shop interest and the British section includes only two collections of machine tools.

Italy's Exhibit

Giving first place to Italian products, a dozen native firms exhibit, two or three of which call for notice. Simple woodworking machinery abounds, both here and in the Swiss section (part of the electricity hall elsewhere), and it has been explained that the idea in this direction is to help the small man or firm. Two Italian firms, however, are prominent both for finish and design—Michele Ansaldi, Turin, who specializes in shapers and ordinary engine lathes, and Dubosc, also of Turin, who has quite a wide range of tools.

The Ansaldi tools will be recognized as workmanlike. They include examples of a set of six single-pulley lathes, with hights of centers of 165 millimeters, 195 millimeters, 225 millimeters, 265 millimeters, 325 millimeters and 405 millimeters, that is, ranging from, say, 13 inches swing to 32 inches. With two-speed countershafts, the spindles are gear driven, the speeds, 16 to 32 according to size of lathe, being controlled by three levers. The saddle motion can be reversed by a lever placed at the end of the apron. This lever is fixed on a rod in front of the bed and connected by levers and links to a reversing clutch and bevel-gear system in the fast headstock. A stop system is also formed. A gear box gives four feeds and the lead screw is usually of ¼-inch pitch. A Hendey-Norton box giving 48 feeds or threads can be supplied if required. Taking the largest machine with 405 millimeters (say 16 inches) hight of centers, this will turn 610 millimeters (say 24 inches) over the carriage and will swing 1290 millimeters (50¾ inches) in the gap. The bed is 675 millimeters (26½ inches) wide and the usual distance between the centers is 2500 millimeters (say 98½ inches), the usual length of the bed being 5100 millimeters (200¾ inches). The spindle, with 50 millimeters (2 inches) hole right through, is 140 millimeters (5½ inches) diameter, by 250 millimeters (9⅞ inches) long in the front bearing. The driving pulley is 500 millimeters (19⅝ inches) diameter by 185 millimeters (7¼ inches) wide, and the 32 spindle speeds range from 2 to 220 revolutions per minute, the weight of the lathe being about 5400 kilograms, or about 11,880 pounds. Traveling-table shapers are made in two sizes, with 400-millimeter (15¾-inch) and 600-millimeter (23⅝-inch) strokes. The general design is fairly conventional. The drive is obtained from four pulleys, fast and loose in pairs, actuating a double set of gearing to drive a rack on the ram. The pulleys, of course, give rapid return. The tool box can be swiveled 45 degrees either side from the vertical and automatic downward motion is fitted if required. The frame carrying the table has square guides and can be adjusted vertically by screw, with the usual automatic horizontal motion by screw. Sliding on the base, a bracket in front supports the table and takes the downward pressure of the cut. The overhead gear has two speeds, one for cast iron and the other for steel. Taking the larger, that is, the 600-millimeter stroke machine, the transverse motion of the table is 650 millimeters (25½ inches) and the vertical movement of the tool 150 millimeters (5⅞ inches). The table is 305x435 millimeters (12x17⅛ inches, say), with vertical adjustment of 450 millimeters (17¾ inches). For keyway cutting the machine will admit a 65-millimeter (2½-inch) shaft. The driving belt is 75 millimeters (nearly 3 inches) wide, and the tools employed are 16x32 millimeters (⅝x1¼ inches) in section. The machine weighs about 1050 kilograms, or, say, 2310 pounds.

The Bickford-type drill will be seen, with 14 spindle speeds, seven from a gear box being doubled by back gear on the drill head. The radius of the machine is 1 meter (39⅜ inches), and the maximum distance from the spindle to the base is about 1.1 meters (43¼ inches). Another drill, this time a sensitive radial, with a maximum radius of 650 millimeters (24¼ inches), is designed on the machine by Jones, Pollard & Shipman, Leicester. Also a combination lathe as by Alfred Herbert, Ltd., Coventry, is exhibited, but with one or two differences, as, for instance, in the application of change gears for thread cutting. Universal milling machines with vertical milling attahcments made by the Dubosc firm, are of interest on account of the cone gear employed for the feeds and speeds. Two sizes are supplied, the smaller having movements of 600 millimeters (23⅜ inches) by 220 millimeters (8⅝ inches) cross and 440 millimeters (17⅜ inches) vertical; 14 feeds and speeds are available, the seven obtained from the gearbox being doubled by back gear. A single cone of gears is used, the feeds being taken off one side and the speeds off the other. In each case the adjustable pinion slides on an arm which swings and the gears are bevel instead of spur. The well known automatic bevel-gear cutter, manufactured for several years by the Turin firm, is shown in a somewhat redesigned form. The tool exhibited will deal with miter gear of 500 millimeters maximum diameter by 16 module. A gap lathe, with back gear below the head controlled by lever, is of 350 millimeters (13¾ inches) hight of centers by 3 meters (118⅛ inches) between centers. A shaper made by the firm has a ram which slides on bronze, with strips adjustable both vertically and horizontally. In a triple-geared flywheel lathe quick taper turning can be managed by a combined movement of the tool slides, special gear providing for this. Another lathe has four guides, the outers being vees and the inner guides, for the back center, a vee and a flat. These middle guides, stopping short of the fast head, leave a gap, and the section of the bed here is hollowed to increase the swing. Over the saddle the lathe will turn jobs 400 millimeters (15¾ inches) diameter, by 2 meters (78¾ inches) long. In the gap the maximum swing possible is 650 millimeters (25½ inches) by about 320 millimeters (12⅝ inches) from the face of the chuck. With a two-speed countershaft and six speeds by sliding gears, 12 spindle speeds are obtained, the fastest being a direct drive from the belt. End thrust of the spindle is taken on hardened steel and fiber rings. In addition to a cone gear box giving 18 threads or feeds, a change-wheel system is available. Four turning feeds are obtained from the front shaft and gear box. Large holes for the disposal of cut-

tings form a feature of the bed design. On an adjoining stand may be seen file-cutting machines made by the Dubosc firm, but founded on German methods.

Merely as an approach to completeness we mention that A. Passoni, Milan, and Pogliano, Turin, show several small machine tools, the latter firm including an Italian made gear hobber and moving-head shapers; that woodworking machines are exhibited by Segre & Locati, Turin; by Bombaglio, Legnano; by Zanelli, Turin, and Manfredi, of Mondovi; while Lizzoli & Co., Novara, show a number of small simple drilling machines, and Fonderie Subalpine, Berto & Co., Turin, and Turco Bernardo, Turin, show ranges of small tools; Pagani, Milan, exhibits friction-driven and other presses.

German Display Is Most Complete

The German machine-tool section is undoubtedly most complete of all. It ranges from the smallest balls and ball bearings through all the recognized workshop tools, machine and hand, up to heavy punching and shearing machinery. The firm of H. Pels & Co., Berlin, has a somewhat larger display of its machines for notching, shearing, cropping and punching than it had at Brussels. With the Johns mechanism the feature, of course, is the use of rolled-steel plates built up to form practically unbreakable frames. No new tool is on the stand, the one-stroke joist shears, the most recent, having been exhibited in Manchester last year. The machine shown will cut girders and channels up to 90 millimeters (3½ inches) by 260 millimeters (10¼ inches). The design, however, is made larger; one size, for instance, will cut British standard joists up to 24x7½ inches. The largest beam rolled can be cut in less than ¾ minute. The driving motor is often bracket-supported on top of the frame, but it may be placed in any other convenient position. The motor drives by belt to a flywheel and thus by double spur gearing to an eccentric shaft, with plunger and stop motion. All joists are cut by movement of a single renewable top blade, which is of vee form with rounded point. The bottom stationary blades are usually supplied in sets of various width, the blocks carrying them being supported on a horizontal shaft round which they swing, so that, according to the girder to be severed, the required pair can easily be placed in position, bearing on the baseplate and being centered by key and groove. The web of an H-girder rests on them, of course. The side blades or blocks for the girder flanges are adjustable simultaneously by geared right- and left-hand screws and handwheel. The cut being completed, the plunger is disengaged and the slide is lifted to its first position by means of balance weights. The full travel is usually made in steps, the number varying according to the section to be cut.

The grinding machinery shown by Naxos Union, Frankfort, although probably the largest collection of the kind in the exhibition, is of fairly ordinary construction. Mayer & Schmidt, Offenbach, who also are exhibiting grinders of various kinds, include a segmental machine. The wheel, about 1 meter (39⅜ inches) diameter, carries 10 abrasive segments clamped to a metal ring. In front of the wheel a horizontal table carrying the job has a travel of about 1.5 meters (59 inches). The face of the emery head is about 4 millimeters out of parallel with the table travel. Any ordinary abrasive can be employed, and at each stroke the machine will remove a thickness of 3 millimeters (say, 1/9 inch) in cast iron. A 45-horsepower motor is employed. The machine is used where quick work with a fair measure of accuracy is needed, as, for instance, on bases and feet. Among the tools on the stand of the Saechsische Company, Chemnitz, is a 20-horsepower lathe with motor placed on top of the fixed head and joined up by coupling to gearing. Both the carriage (as usual) and the back headstock can be moved along the bed by the motor, which, by means of gears, gives 18 spindle speeds. The lathe is of 400 millimeters (15¾ inches) hight of centers, the maximum distance between centers being 4 meters (157½ inches), and the maximum diameter turned over the carriage 500 millimeters (19⅝ inches). A rack-driven planer with 17-horsepower motor will take jobs 1.25 meters (49⅛ inches) wide and high by 3 meters (118⅛ inches) long, the table being 1 meter (39⅜ inches) wide. The cutting speeds, 150 millimeters and 200 millimeters a second, correspond to, say, 30 feet and 40 feet a minute, while the speed of return is 500 millimeters a second, or 100 feet a minute. The same firm also shows a horizontal borer and miller with a mandrel 120 millimeters (say, 4¾ inches) diameter, and with a maximum length of hole bored of about 1 meter (39⅜ inches), though this can be doubled. The maximum and minimum hights of the mandrel above the bed are, respectively, 1.85 meters (72⅞ inches) and 450 millimeters (17¾ inches), the movement of the head along the bed being 3 meters (118 inches).

Ludwig Loewe & Co., Berlin, have perhaps, within the limits of size, the widest range of machine tools in the section. Norton-type grinders are exhibited, one for jobs 250 millimeters (9⅞ inches) by 1.5 meters (49 inches) and the other for jobs 450 millimeters (17¾ inches) by 2.5 meters (say, 98⅜ inches), and both set up for crank shafts. The remainder of the 16 machines on view range from ball-bearing sensitive drillers with one to four spindles, four speeds to the spindle, used to drill holes 19 millimeters (¾ inch) by 110 millimeters (4¼ inches) deep, to a single-pulley roughing lathe, without lead screw. This is 250 millimeters (9⅞ inches) hight of centers, to take jobs 2.1 meters (82⅝ inches) long, the length of the bed being 3.75 meters (147⅝ inches), and the diameter admitted 300 millimeters (say, 11¾ inches). With duplex tool slide it will remove 300 kilograms (660 pounds) an hour of mild steel of 50-kilogram resistance, the depth of cut being 37.5 millimeters, or 75 millimeters (3 inches nearly) on the diameter. Driven by single pulley, 400 millimeters (p⅞ inch) diameter by 80 100 millimeters (nearly 4 inches) wide, and friction-clutch controlled gears, the spindle has eight speeds, from 12.6 to 240 revolutions per minute, and the eight feeds, from a gear box and rack, range from 0.25 millimeter to 2.75 millimeters per revolution. A gear-cutting machine can be used both for milling and hobbing for gears up to 580 millimeters (say, 23 inches) by 6 module or 4.23 diametral. An automatic turning machine with three sets of tools, to produce jobs up to 22 millimeters (⅞ inch) diameter by 80 millimeters (3⅛ inches) long, three simultaneously from the same bar, is also included. Millers, both horizontal and vertical, shapers and several other lathes are on the stand.

Millers of various kinds, plain and universal, with practically every kind of drive, vertical millers and thread millers, occupy the machine-tool section of the stand of Wanderer Werke, Schönau, Chemnitz. One vertical machine has a working surface to the table of 1700 millimeters (66⅞ inches) by 465 millimeters (18¼ inches), the longitudinal movement being 1100 millimeters (43¼ inches), the transverse movement 360 millimeters (14⅛ inches) and the vertical adjustment 510 millimeters (20 inches). This machine is driven by constant-speed pulley and friction clutch, and, with the gears, 16 spindle speeds can be obtained. Each table movement has 16 feeds in either direction, the feeds and spindle speeds being independent, and all table movements having adjustable stops. The thread miller shown is driven by electric motor and will produce threads up to 2.5 meters (98⅜ inches) long and 175 millimeters (6⅞ inches) diameter. The maximum distance between centers of chuck spindle and milling spindle is 140 millimeters (5½ inches), and the minimum distance 20 millimeters (¾ inch), the maximum milling depth being 16 millimeters (⅝ inch). Still making only a selection of the German tools we note that the Pittler firm, Leipsic, has a large stand of its well known turning machines, almost all its types being represented, together with one or two cutter grinders. The automatic machines include an all-gear driven tool to turn

56 millimeters (2¼ inches nearly) diameter by 125 millimeters (4⅞ inches) long, and cut 1¼-inch threads, the head carrying five tools. Other stands with ranges of their productions include Zimmerman, Chemnitz; De Fries & Co., Düsseldorf, and Maffei, Munich; while Schuler, of Göppingen, and Hübner show many types of presses. The firm of Heller, Nürtingen, shows a driller at first sight of radical type, but with an arm which does not swing; it is adjusted vertically on the column, to the front flat face of which it can be clamped. Then a lathe by Heinrich, of Chemnitz, has a cone-gear head, the pinion, for the variation of speed, being moved to required position by means of a chain.

In the French section the Cail Company, Denain, shows a planer-type miller with a bed 5 meters (196⅞ inches long), the stroke of the table being 3.5 meters (137¾ inches), and the distance between uprights 1.8 meters (70⅞ inches), while the maximum hight admitted under the cutter arbor is 830 millimeters (32⅝ inches). The table is actuated by screw, four speeds being available by gearing. The arbor and driving spindle has five bearings, those near the cutter being adjustable for position. A 40-horsepower variable-speed electric motor drives the machine which, with the motor, weighs 25,000 kilograms, or rather less than 25 English tons. Impact-testing machines and machines on the Brinell ball system for testing hardness, etc., are exhibited. On a large stand Panhard & Levassor, Paris, show much the same machines as at Brussels last year. A number of smaller exhibitors are included in this section, which, by the way, is at one end of electricity hall, but the only other stand to which attention for the moment need be called is that of Bonvillain & Ronceray, Paris, who by apparatus, photographs and samples, make a fairly complete exhibit of their foundry appliances. Special processes are shown for the production of pattern plates, including reversible examples. Stripping plates for use on all round patterns, however intricate, are included, particularly as applied to multi-finned cylinders for automobiles. Both for stripping and pattern plates a special alloy is used, which does not contract on cooling. A rapid molding machine for double-face pattern plates will complete 25 to 30 molds in the hour. Fairly complete apparatus for hydraulic and pneumatic installations in connection with the foundry may be seen, including air compressors, which always stop with the crank 90 degrees from the dead point, so that restarting is an easy matter. The firm, moreover, exhibits a large number of small tools, hand-driven riveting and punching machines, etc. The collection is miscellaneous enough to include spring hammers, air drills and chain blocks with spur gearing only, and claiming an efficiency of 85 per cent.

The Swiss Section

In the Swiss section two stands call for notice. On one, the firm of S. Lambert, Granges, Soleure, shows automatic machines which it makes in four sizes, the smallest to take 5-millimeter rods and the largest 40-millimeter rods. The first named machine has been shown running, turning out brass cheese-head screws, with length overall of about 5/16 inch, the threaded part being 3/32 inch diameter by rather less than ¼ inch. These are said to be produced at the rate of 20 a minute. Three cutting tools are used together with a screwing head. As soon as the screw has been chamfered and parted off, an arm lifts it and presents it against the slitting saw. The motions are cam-controlled, and the machine stops automatically when the bar is completely worked up, a piece, relieved by the stock rod not being in place, throwing the machine belt over.

In the Swiss section, too, Société Suisse de Machines-Outils Oerlikon, shows half a dozen tools. The most interesting, perhaps, is a new lathe of 225 millimeters (9 inches nearly) hight of centers, admitting 1.5 milimeters (59 inches) between centers. The feature of the design is the use of four flat ways on the bed, one pair behind for the back headstock and a pair in front for the saddle. In addition, in front the saddle bears on a ledge below, running the full working length of the bed. As in the well known lathe by Darling & Sellers, Keighley, this lower tier is devised to carry the overhang of the saddle and take the downward pressure of the cut. The back pair of ways stop short of the faceplate, providing some measure of gap, whereas the front ways, brought forward, of course, run past the faceplate. The screw, twin in this case, is arranged directly under the tool point with the lathe turning full diameter. Over the carriage this is 380 millimeters (15 inches, say), and over the bed 450 millimeters (17¾ inches nearly), the diameter of the faceplate being 420 millimeters (say, 16½ inches). With a three-step cone and gearing the 18 spindle speeds range from 10 to 510 revolutions a minute. A box gives six feeds. In some tests on 50-kilogram steel 170 kilograms (375 pounds) of metal has been removed in an hour, and on 70-kilogram steel 135 kilograms (292 pounds). The lathe itself weighs about 3200 kilograms (7040 pounds). The firm shows its twin-tool bevel-gear shaper to cut up to 500 millimeters (19⅝ inches) diameter by 15 module teeth and driven by 6-horsepower three-phase motor.

A horizontal borer and miller, transportable, is driven by an 8-horsepower motor, the diameter of the spindle being 125 millimeters (5⅞ inches) and the depth of the hole bored 1 meter (39⅜ inches), the maximum distance between spindle and bed being 2.3 meters (90½ inches) and the minimum distance about 900 millimeters (35⅜ inches). The 16 speeds of the spindle range from 1½ to 100 revolutions a minute, and the six feeds from 0.12 millimeter to 6 millimeters (¼ inch) per revolution. A universal radial driller has a radius of 2 meters (78¾ inches), and will drill 70-millimeter (2¾-inch) holes. It has eight speeds from 13 to 280 revolutions per minute, and the six feeds, as given, are from 0.06 millimeter to 1.2 millimeters. A vertical driller driven by 8-horsepower motor, will cut 60-millimeter (2⅜-inch) holes by 300 millimeters (11⅞ inches) deep, the distance from the flat face of the column to the center of the driller being 425 millimeters (16¾ inches). The maximum distance from spindle to the square table is 700 millimeters (27½ inches), or to the base 1050 millimeters (51⅜ inches). The eight speeds range from 23 to 600 revolutions per minute. The remaining machine is a sensitive driller which can be had with from one to four spindles, to drill 25-millimeter (1-inch) holes by 160 millimeters (6¼ inches) deep, the four spindle speeds ranging from 500 to 2050 revolutions per minute. It is stated that 20-millimeter (¾-inch) holes, 25 millimeters (1 inch) deep can be cut in steel in seven seconds.

The British Machine Tools

Finally, in the British section, apart from one or two displays of high-speed steels, etc., only two stands call for special notice. On the comparatively heavy side, Hulse & Co., Ltd., Manchester, show an 18-inch stroke shaper with traversing table, the longitudinal movements being 27 inches, while the vertical adjustment of the saddle is 16 inches, and of the tool 6 inches. A slotted-link motion gives central thrust to the ram, with quick return. The tool box has segment wheel and worm for internal curved work, and the usual indexed swivel slide and hand and self-acting vertical and angular feeds. The table is 18 inches long by 14x14 inches. An adjustable support is provided and the weight of the machine is about 1½ tons. A 3-inch spindle horizontal driller, borer, tapper, studder and miller will cover 8 feet horizontally and 5 feet vertically, the maximum distance from center of spindle to top of the base plate being 6 feet 9 inches. By means of a screw, the box-section upright, 9 feet 10 inches high by 2 feet on front face, can be moved along the slide bed, 12 feet 3 inches long by 3 feet by 1 foot deep. Projections are cast on the bed to take a base plate. The spindle slide is balanced by weight, and all the self-acting motions have interlocking arrangements by which it is impossible to engage conflicting gears. The drive is by a 10-horsepower motor with speed variation of

3 to 1, and then by machine-cut double helical gears. The motor is mounted on the upright, and all motions are controlled from the spindle slide. The range of spindle speeds is from 3 to 170 revolutions per minute. Self-acting motion in either directon is provided up to 30 inches by rack and change wheels and clutch-releasing and reversing gears are fitted to the spindle and slide. The range of drilling feeds is from 1/144 inch to ¼ inch per revolution, with 18 changes, and the milling feeds range from 0.009 inch to 0.33 inch per revolution. The weight of the machine is about 7½ tons. Another tool on this stand is a treble-geared planer-type miller to machine 5 inches in length and admit 2 feet 6 inches wide by 1 foot 6 inches high. This machine weighs about 4¼ tons. A double-geared vertical miller, driller and profiler will admit 3 feet diameter, the distance from the lower table to the spindle nose being 24 inches, and from circular table to nose 16 inches, while the traverse of the table both longitudinally and transversely is 24 feet.

The other stand, that of Alfred Herbert, is designed on the firm's regular exhibition principle, namely, as a model workshop. It is driven by a 30-brake horsepower Lancashire dynamo and Westinghouse chain. Several small American auxiliary tools are shown, together with a 14x50-inch Norton grinder. The productions of the Herbert firm itself on the stand include hexagon turret and capstan lathes, three-spindle ball-bearing drillers with one of the spindles geared, a 3-foot ball-bearing radial driller, cutter grinder and horizontal and vertical millers. A new automatic screw machine with self-selecting feeds and roller-steady turning tools is in operation, producing, for instance, a ⅝-inch bolt 2⅝ inches long under the head, threaded for a length of 1½ inches in 25 tons tensile steel in an average time of 1 minute 40 seconds. Special tool grinders, a duplex vertical boring and turning mill by Webster & Bennett, Coventry, a universal woodworking machine by Wadkin & Co., Leicester,, and a bevel-gear generator on Bilgram-Reinecker lines by David Brown & Sons, Huddersfield, are shown in operation, the last named machine being driven by a four-speed gear box with machine-cut helical gear. From 75 to 150 strokes a minute are made. The tool, as usual, is of triangular section, the included angle being 29 degrees. Excepting as regards the dividing motion, the operation is automatic. The dividing head has a large worm wheel, further operated through division plates. The largest diameter of gear taken is 18 inches, the smallest 2 inches, the largest ratio 1 to 5, the widest face 6 inches; maximum pitch 1¼ inches.

Restoring the Personal Touch

By O. M. Becker

Some of the methods by which the desired co-operation and loyalty, with its increased efficiency, can be obtained.

The policy of being human in business, of treating employees like human beings rather than like inexpensive and readily replaced parts of the inanimate equipment, or worse, can be shown, and over and over again has been shown, to be profitable and "good business." Common sense indeed would indicate that if it is worth while to spend money to keep a lathe in good repair, it certainly must be much more worth while to have the lathe operator in good health and physical condition. This merely from the standpoint of mechanical efficiency, and aside from the influence of mental attitude and mental health upon physical efficiency. If, then, the physical condition and the mental attitude of the employee can both be kept harmonized with the requirements of efficient service, the gain is so much the greater.

Doubtless there will be inquiries as to how it can be shown in a tangible way that the policy of carefully regarding the environment and personal welfare of employees is advantageous.

In a general way the advantage is so obvious as scarcely to need pointing out. Anybody with even a small knowledge of human nature, knows the influence of kindness and consideration, upon men and women. Consideration begets consideration—and more. It develops interest and loyalty, which are assets that every wise business man seeks after in his working force. The value of a permanent, content, loyal and interested corps of workers is not to be computed in tangible units. Nevertheless the returns ultimately show up in the balance sheet in some form or other, even if not directly traceable to the primary cause. They appear as a result of cheapened product made possible by better quality and increased quantity of output, and the permanence of an undisturbed working force; not that a "welfare department" in a business necessarily eliminates disagreements with employees and avoids strikes.

As a matter of fact there have been strikes and labor troubles in more than one business establishment whose management has been more or less genuinely interested in the welfare of the employees; there has been discontent with wages, with the tyranny of petty bosses, with this and with that. But this is certainly and clearly established: that in those places where the employer has shown that that he wishes his employees to have clean, comfortable, sanitary and agreeable surroundings and mentally and morally stimulating working conditions (and this showing is merely one of the many evidences that he is absolutely honest in his attitude toward them), then disagreements, disturbances and interruptions in production are comparatively rare. That they should never occur under such conditions is to ask too much of human nature, which is still selfish and not infrequently misguided.

The Personal Touch and Loyalty

Under the existing organization of our industrial system there will be bickerings as to wages and hours; and tactless bosses and malcontent workers will continue to be sources of trouble. Every experienced employer knows that questions of wages, however, and of hours, are at the bottom of a relatively small part of those difficulties covered under the somewhat indefinite term labor troubles. Most of them, by far, arise from bad working conditions or the bad treatment of petty bosses who may lack judgment or be possessed of the one idea that they must "make a showing," as they think. The same conditions which necessitate the aggregation of workers in large units, operate to prevent the employer exercising that personal touch which is characteristic of the small business, and places the immediate management of the men in the hands of subordinates.

The restoration of this touch, this re-establishment of the feeling that both employed and employer are human and are for the time being in a social and ethical relationship to which both are bound to apply the tests of good morals, and therefore of good business, has as much to do with the highest efficiency in the conduct of a large business as it ever had in the days of small businesses, when the employer and employee worked side by side and the relationship was so perfectly obvious as to be a matter of course. Undoubtedly one of the chief causes of slipshod workmanship, wasted time, spoiled material and general indifference to the interests of the business, all of which make for inefficiency in a working force, comes from the indifference of the business toward the worker. It is merely a

matter of natural compensation—a reciprocal relation founded upon the attitude which the management takes, whether consciously or unconsciously, toward the work people.

All too often, considered with reference both to the ethics of the case and the results in a business way, the business is a mere organization, a great machine, an unhuman (not to say inhuman) thing. The employee works for "the company." The man or men behind it are nothing but names to him—if even that. They are overshadowed by the organization, the tangible plant. The "company" itself comes, in the mind of the employee, to be only the aggregation of buildings and machines and materials and other things, which represent to his eye the tangible entity for which he toils; and it is all concentrated, so far as he is concerned, in the petty boss or foreman from whom he takes orders.

Has he a grievance? Perhaps the boss will take cognizance of it and correct it; perhaps, and more likely, not. Is the sanitation bad? Must one expend a large part of his energy in useless work, work which only serves to tire but does not add to his efficiency? If the boss does not care, that is the end of it. One quits the job if he does not like its conditions. Behind and beyond the boss is a shadowy somebody; but he is unreachable. Very likely he also is indifferent, anyway; so what is the use? Do, therefore, what one must to hold the job, and get another when convenient—provided, always, one can stay on good terms with the boss. That comes to be the attitude of the worker toward the employer who leaves out of his account the human side of his problem. His business may be prospering; but compared with what it might do, the efficiency that might be obtained from his work people, it falls far short of what is possible. Men are not, and cannot be, loyal to a lot of brick and mortar and machinery.

Employers are awakening to the cash value of fulfilled moral obligation, and the question of how that sense of personal relationship, that loyalty and interest on the part of employees which springs from a recognition of interest on the part of employer, can be restored is being asked.

Continuity of Employment

It is very largely a matter of administrative policy, and scarcely at all a matter of doing this particular thing, or that. Fundamental to the whole thing, however, is the matter of wages, continuity of employment, and hours. Wages are regulated by conditions over which no one employer has control, and he simply buys on the open market. If he wants a better quality than the ordinary, he pays a higher price.

The maximum working period obviously is closely related to the question of wages; but unlike that question is within the control of the individual employer, in most cases. Ordinarily it is quite ignored. Employers very generally content themselves with hiring such workers as are needed and paying such wages as may be necessary, without considering the matter of continuity of employment. The workers are given work when there happens to be plenty to do, and laid off when there is not. The result, to the worker, is a considerable reduction in the actual wage; and to the employer, a constantly changing working force, with its relatively low efficiency and much idle equipment. It is, therefore, a shiftless policy, one that not only can be changed with great advantage in practically every line of business, but is being changed by many employers.

A third fundamental which the worker is entitled to, and which he is more and more insisting upon, is safe, decent, and even agreeable surroundings and working conditions. Such conditions have been sadly wanting in the past, it is true. Sweat-shop and packing-house environments have been by no means confined to the clothing and meat business; in fact they have been all but universal, until recently. Public sentiment enacted into law, and the business sense of employers, together have made many of the old conditions impossible in modern business. Nevertheless there is still room in most establishments for improvements in these respects; improvements that can be made to add largely to the efficiency of the plant.

The "welfare" policy of management has been so much ridiculed by men who have had no experience with it, that it may be well to consider what is meant by it. Ordinarily it is thought to involve such a course of action in the management and the establishment of such institutions as will redound to the personal benefit of the employees, physically and socially. This may, in part, be the case. Such a policy, however, savors of that paternalism which good managers try to avoid and which employees resent.

There are institutions in business establishments which go under the name "welfare" which are open to this criticism, but we can point out certain provisions which are so obviously rational as to need no discussion.

First, undoubtedly, comes the guarantee of personal safety, protection against accident and injury. While it is true that plenty of people can be found to work under unsafe conditions, it is equally true that the tendency of legislation and court decisions is toward making injuries to employees increasingly costly to employers. Inspection laws now compel installations assuring safety in a general way. The astonishingly large number of accidents and injuries occurring in all large establishments are nearly all of a minor and generally of a trivial sort. Practically all, however, are preventable, and if not prevented, occasion not only the loss of time by the injured employee, but generally by others also. That many such injuries occur through the carelessness or foolhardiness of the employees themselves signifies nothing, so far as the ensuing expense and loss of time are concerned. No work room can be said to be properly safeguarded unless it is quite "fool proof;" that is, until it is positively difficult to get hurt.

The most obvious sources of danger are generally guarded. Big belts are fenced in, elevator shafts closed and the elevators themselves provided with safety clutches, large gears are covered, and the like. But most injuries come from less obvious sources—unguarded moving parts of machines, belts within the range of the workman's necessary movements or improperly laced or old and worn, rough floors or floors with holes in them, unlighted corners in the shops, material scattered on the floor, projecting shafting, exposed countershafts, worn jigs, and a hundred others. All these things are easily and inexpensively remedied, once they are seen. And they should be seen. It should be somebody's business to see such things, and to correct them.

Not only should there be adequate provision looking to the prevention of accidents; but there should be proper provision for immediate treatment in case injuries occur. In the large plant the nurse or house physician is almost a necessity, as a matter of protection against fraudulent claims for damages and perhaps aggravated cases arising through the infection of wounds trivial in themselves. In a good many cases it is found desirable to have a well appointed emergency hospital in charge of the nurse or physician; and in not a few instances, chiefly railroads, completely equipped hospitals are found necessary.

In the lesser plant it is perhaps sufficient that there be within reach a qualified nurse or physician, who may be called upon in serious cases; and scattered through the shops a number of employees sufficiently informed and skilled to administer "first aid" in any case that might come up, as well as attend to all minor injuries themselves. An excellent help for this purpose is a case of lints, bandages, and the other simpler necessities of the sort, kept within convenient reach of the persons authorized to make use of them. Such cases are now to be obtained ready for use, at small expense.

Along with conveniences for washing up naturally go provisions for storing the street clothing by day and shop clothing by night, and preferably also for drying out either in case of need; and where women are employed, opportunity for privacy when making the change. Men generally prefer lockers along the walls

of the shops, where they are always in sight and reachable with the least possible trouble. It is not certain, however, that this arrangement is best. For women a dressing room in connection with the lockers and lavatories is certainly a necessity.

Naturally sanitary closets also go along with these things, as tending to the conservation of the health and comfort of employees. Scarcely any place where people work is nowadays without some sort of convenience of this nature; but in an astonishingly large proportion of such places the conveniences are inadequate, unsanitary and nasty, giving certain evidence that little attention is bestowed upon this side of the factory equipment.

Bad Lighting is Costly

Bad lighting is a more common source of loss to employers than is generally realized. Saying nothing of the necessity for increased expense for artificial light when factory buildings are poorly lighted, and the unnecessary strain imposed upon operatives working in a dim light, this condition encourages slovenly work, affords opportunities for hiding spoiled pieces, and permits more or less shirking. The matter of eye strain alone is of sufficient importance to warrant careful attention to the providing of well lighted work rooms.

In new buildings, of course, this can be taken care of readily, though it is surprising that in so many cases it is little regarded. In old buildings, and those more or less shut off from natural light, the use of ribbed or other forms of diffusing glass, in connection with whitening of interior and exterior walls also, where the latter will serve to reflect light into rooms, will greatly improve conditions. The result is necessarily stimulating to workers and, therefore, advantageous to employer; wherefore it is rational welfare.

Formerly it was thought that sitting at work was a certain evidence of laziness. It is now regarded by intelligent employers as an evidence of sense on the part of the worker, when he conserves his strength by sitting at his work as much as possible. No argument ought to be necessary to show that every bit of energy unnecessarily expended at a job lessens by so much the possible output, and that seats are, therefore, not only a comfort to the worker but a source of increased output to the employer. For women especially it has been for some time the custom of many employers to provide seats. Men are generally allowed to shift for themselves, no objection usually being made to their making use of packing boxes and kegs for this purpose. It does not appear why, if chairs are desirable for women, they are not equally desirable for men.

Not only may energy be saved by allowing employees to sit at their work, where the nature of it will permit, but other means are made use of to reduce the fatigue of the day. Such is the running of elevators, otherwise idle at that time, for transporting employees to the several floors at beginning and closing of work. It costs little and conserves much energy.

There are, of course, other conditions that make for or against the development of a coöperative, well spirited, loyal and interested corps of employees, and in some instances they may be fully as important as any that have been mentioned. In general, however, these cover all (except supplying good drinking water) the so called "betterments" or "welfare" institutions that are absolutely fundamental and concerning whose necessity and desirability there can be no discussion. Some of the recent efforts at "welfare" featuring are indeed laughable, from a business point of view; though in certain instances the promoters undoubtedly secure more than their money's worth in advertising, through this means.

A Crank Shaft Repair Job

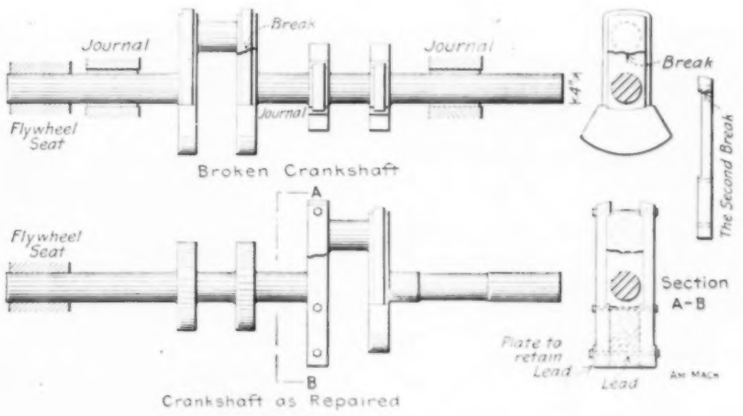
By A. F. Steedman

The shaft was part of a compound portable engine, which was employed to drive a sawmill. Up to the time the crack was noticed, the shaft had given no trouble, and there was no sign that the strap holding the balance weight had been strained in any way. However, for safety, it was decided to have it repaired at once. After consideration, I decided to effect repairs as shown in the accompanying figure. I used the largest bar of iron available, a piece of 3½-inch round, which was forged to the section shown in the figure.

When the strap that held the balance weight in position was cut, the shaft fell apart. The fracture had a polished look and appeared as if the two parts had been working together; the shaft seemed to have been broken for some time. The straps were made a trifle shorter between the jaws than the length of the crank web and put on hot, so that when cooling they pulled the broken parts together with great force. The long ends were left so as to compensate as much as possible for the loss of the balance weight. I was rather doubtful about the truth of the shaft, but when it was put in place it ran splendidly.

A month later, the shaft was broken again. One of the straps had given way. It evidently had been broken for some time, as the other strap had worked quite loose and the fracture of the crank web was considerably chafed. I repaired the shaft as before.

I decided to turn the shaft, end for end, so that, in the event of another breakdown, it would be possible to run with one crank. This, of course, also reduced the stress on the broken web. Owing to the chafing of the fracture, the shaft was now considerably out of true. As we had no lathe big enough to swing it, our largest lathe, a 12½-inch center, had to be blocked up to suit. The shaft was set so that two of the journals ran true and a cut was taken off the remaining journal, this, of course, being the end journal nearest the broken crank. Truing this reduced the diameter by 3/16 of an inch. It was necessary only to true the journal and a seat for the eccentric sheave; by reversing the shaft, I avoided having to turn the flywheel seat and line up the flywheel.



A Crank-shaft Repair Job

As we had no means of turning the crank pin, I decided to put the shaft in place and, if necessary, true the crank pin with hammer and chisel and file. To my surprise, however, it gave no trouble.

The engine has been running for two months now, and so far the job appears to be a success. As they are short of power at the mill, the engine is run with the valve wide open and the steam is just on the blowing-off point all the time —rather trying conditions for a broken crank shaft.

Making a Quick Change Gear Box

Western Correspondence

Method of machining a gear box in drill jigs and boring fixtures in which the work is located by simple means and operated upon by tools which are fitted with long bushings that take the wear from the fixed bushings in the jig.

The quick-change gear box of the lathes built by the R. K. LeBlond Machine Tool Company, Cincinnati, Ohio, is made up of the casing itself, the system of gears, the cylinder which incloses the long driving pinion for the gear cone, the yoke which surrounds this cylinder and carries the intermediate pinion for connecting the long driver with any gear in the nest, and the two operating handles which control the mechanism in the box. These parts are all machined with the aid of special tools, a number of which are illustrated by the engravings herewith.

Drilling Jigs

The drawing Fig. 1, illustrates one size of gear box and a few dimensions are given to show the general proportions of the case and cylinder.

The first operation consists in milling the bottom or rear of the box to finish the locating tongues thereon and surface the seats for the caps. This prepares the box for the drill jig Fig. 2, in which the holes for the cap screws, the shift-handle locking holes, the corner holes for the bolts for attaching the box to the lathe bed, and various other holes are put through the casting. In this jig the work is located by its tongues which fit between hard steel plates as indicated. It is positioned endwise by a stop plate secured in the seats at the left end of the jig.

The jig body is fitted with a lid which is seen in the section, Fig. 2, and which is secured by screws and dowels to the jig. The arrangement of the bushes here is clearly shown and it may be stated that in most cases the tools used on the work are provided with independent bushings that are kept on the tool shanks and slipped into the fixed bushes in the jig each time the tools are used. This is in accordance with the Le Blond practice as described fully in an earlier article on this company's methods of machining lathe aprons.

The work itself is indicated in two views in Fig. 2 by dot and dash lines. These are omitted from the plan of the assembled jig in order to avoid confusion. For the same reason detail dimensions are not included in the engraving.

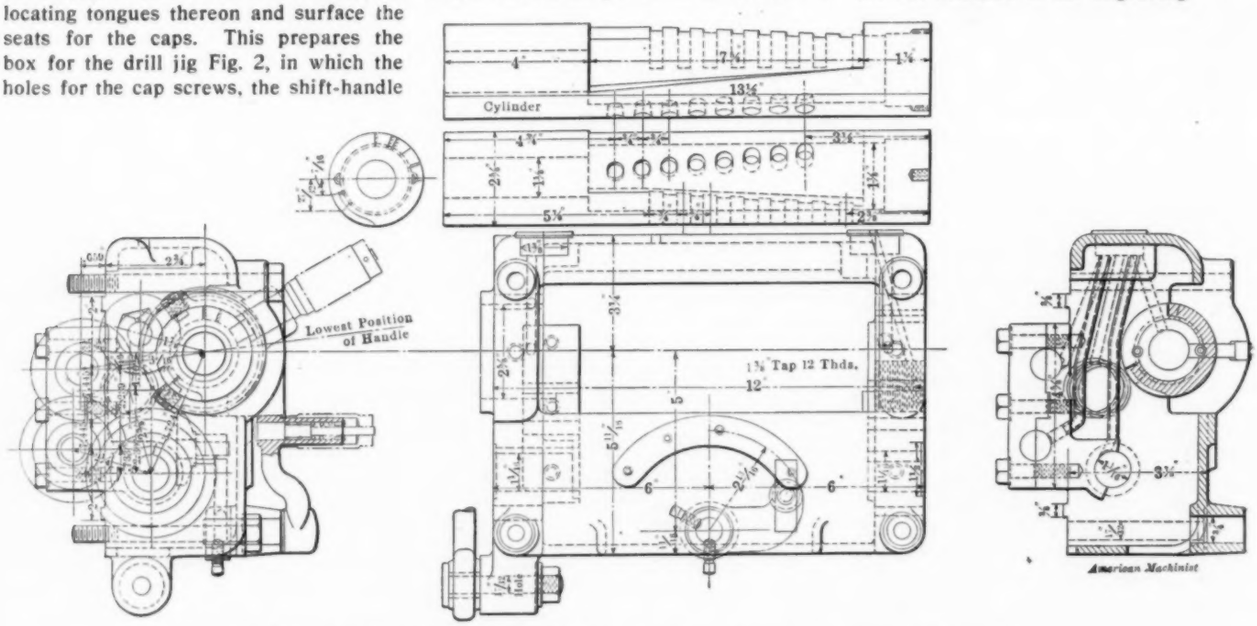


Fig. 1. Quick-change Gear Box for 17-inch Heavy-duty Engine Lathe

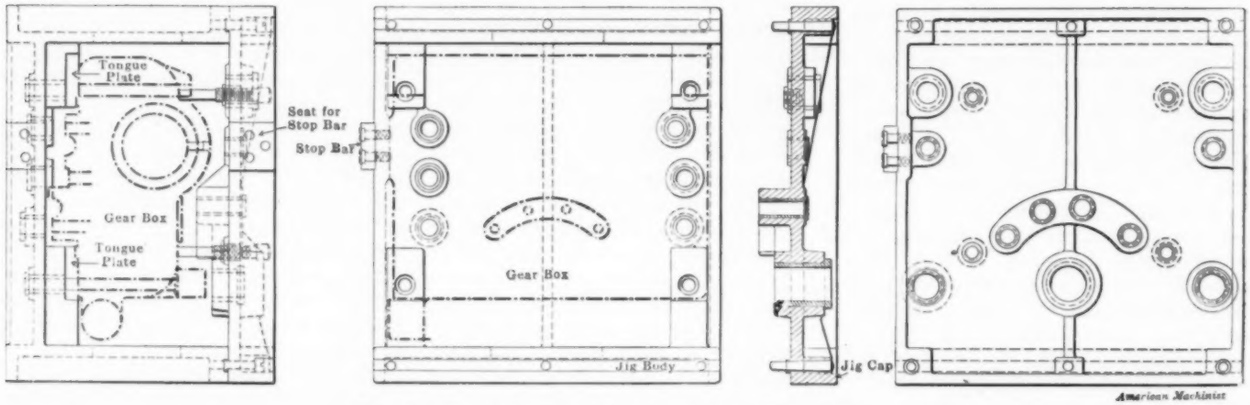


Fig. 2. Drill Jig for Quick-change Gear Box

Milling and Boring Fixtures

After the cap-screw holes have been tapped and the caps attached, the gear box is placed on the miller and the inner surfaces at the ends are faced off. The casting is then ready for mounting in the boring jig, Figs. 3 and 4, where the holes in sides and ends for shaft and stud bearings are accurately bored and reamed with a system of tools, each with its own long guide bushing as already described in connection with the lathe-apron procedure.

The fixture in Figs. 3 and 4 is of the swiveling type and may be indexed to bring one face after another into position for operations under the drill spindle. The fixture is mounted upon an angle plate as in Fig. 4, and the locking pin for the index holes is carried in a horizontal sleeve at the back of the plate.

Provision is made for keeping the indexing work carrier in close contact with the supporting angle plate and at eash setting the fixture is clamped securely by a binder handle seen projecting above the fixture in Fig. 3.

The plan and front elevation of the fixture in Fig. 4 indicate the position of the T-slot for the retaining bolts and show the locking-pin holes at three points in the circle, these three positions giving all the settings required. Here again the work is not shown in all the views as the method of locating by tongue plates and fastening in place with bolts through the corner holes is brought out clearly in the halftone, Fig. 3, and in the left-end elevation, Fig. 4. The right end of the jig has a different group of bushings than are used in the end shown, and the arrangement at this end, which is omitted from the drawing, will be seen upon inspection of the halftone.

The nature of the tools for drilling, boring, reaming and for other operations is revealed in the halftone, where a set of seven tools with their individual cast-iron bushings which fit the fixed bushes in the fixture are shown on the table at the rear.

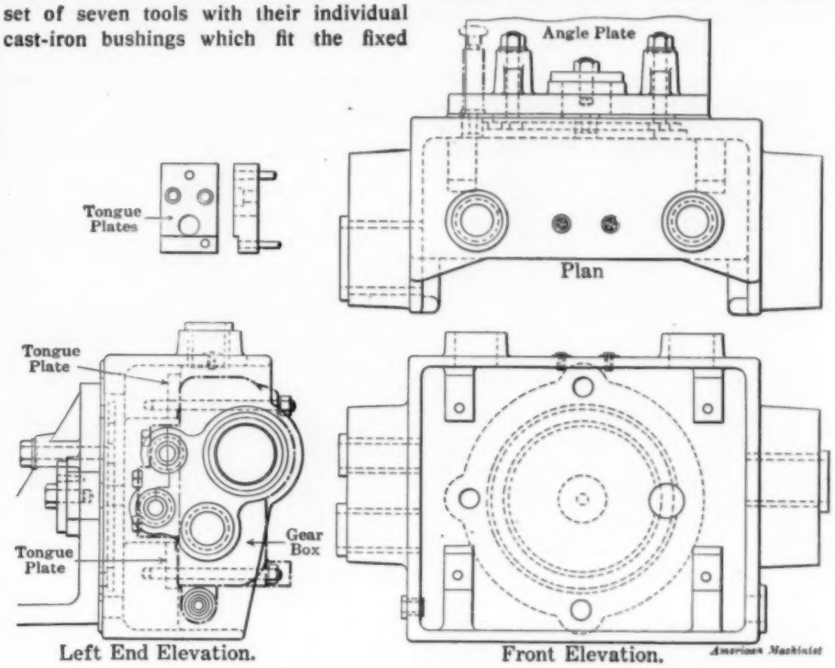


Fig. 4. Jig for Boring Gear Boxes

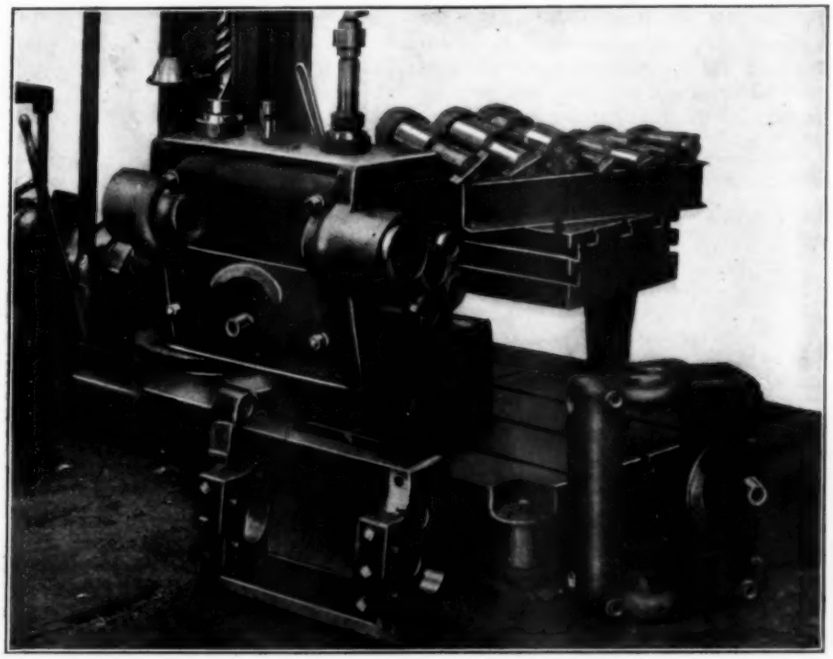


Fig. 3. Swiveling Boring Fixture under Driller

Milling Cylinder Grooves

Upon referring to Fig. 1 it will be noticed that the cylinder in the gear box is provided with a series of grooves part way round the periphery and with as many taper holes, which are nearly opposite the grooves. The grooves and taper openings serve to guide and locate the gear-shifting yoke in making the change from one rate of feed to another, and both grooves and holes must be located correctly to assure smooth and easy transition of the operating mechanism from one position to the next.

The milling fixture for cutting the annular grooves is illustrated by Fig. 5 which represents the device on a Le Blond miller with a gang of cutters finishing the grooves simultaneously. The cylinder (with bore finished and body ground to size) is carried on trunnions in the fixture which is equipped with worm wheel and worm to enable the operator to rotate the cylinder under the cutters by means of a handwheel.

The outer end of the work is carried by a supporting bracket that may be slid in and out to secure or release the cylinder, so the casting is readily removed when the milling cuts are completed and the next cylinder as easily put in place for the grooving operation.

An Indexing Drill Jig

The drilling of the series of holes in the cylinder for the locking pin in the gear-shifting yoke is accomplished by means of the jig in Fig. 6. This jig has a set of index bushings spaced along the work-holding member and as the holes have to be drilled in the cylinder on a line which is at an angle with the axis (as shown by Fig. 1) the process of manipulating the jig after each drilling movement consists in withdrawing the index plunger and sliding the work holder

along, at the same time rotating it sufficiently to bring the next index bush opposite the locking plunger.

The work carrier proper is a partial cylinder with the index bushing located and both drill and reamer are fitted with separate bushings and with quick-acting sockets to facilitate matters.

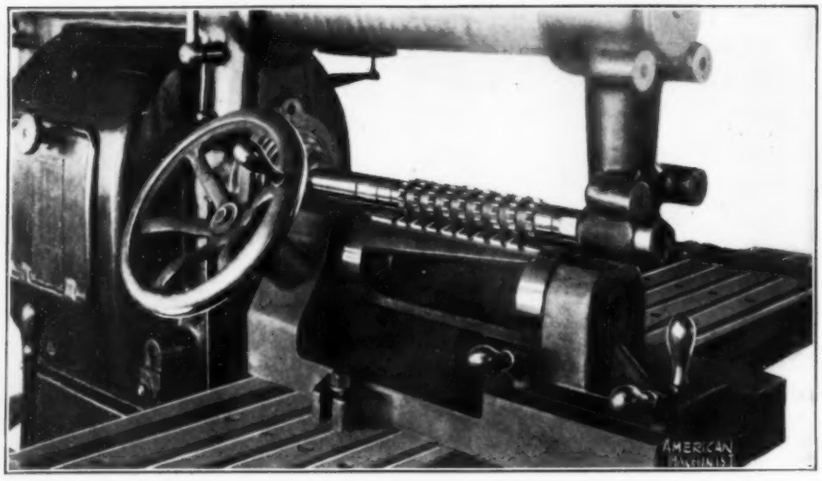


FIG. 5. MILLING GROOVES IN OUTSIDE OF GEAR-BOX CYLINDER

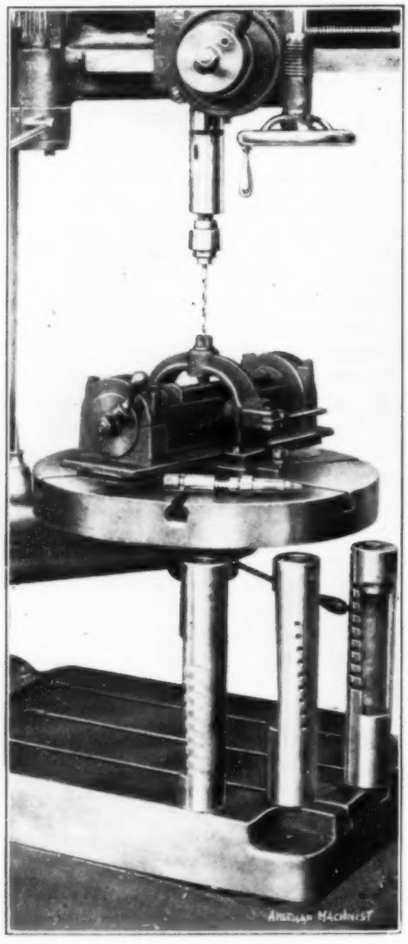


FIG. 6. JIG FOR DRILLING AND REAMING LOCKING-PIN HOLES IN GEAR-BOX CYLINDER

A JIG WITH ANGULAR FACES FOR DRILLING YOKES

The yoke which has been mentioned several times as used on the cylinder for shifting the feed gear, is shown in detail in Fig. 7. Its relation to the rest of the gear-box mechanism may be seen by referring again to Fig. 1. After this member has been bored to fit over the cylinder in its periphery at the necessary angle with the center line. In this casting the cylinder to be drilled is secured by a through-bolt and nut. The carrier is so mounted that it may be rotated, in a sliding head which is adapted to travel crosswise of the base and thus pass step by step under the drill bushing which is secured in a bracket fastened to the base as represented in the halftone.

A taper reamer is used after the drill to form the conical seat in the cylinder for the locking pin of the gear-shift yoke it must be drilled through the two lugs to receive a stud for its pinion and three holes have to be drilled in the circumference.

The jig is a simple tool with the feet at the proper angle so that when the device is resting upon either end the work will be drilled at the required angle. The drawing, Fig. 8, shows the jig and the means of clamping the work, with the boss to be drilled and reamed in a vertical position.

The hole in the two lugs for the gear stud is drilled by turning the jig over on its open face and the drilling operation, like the one just referred to, is followed by a reaming operation through another bushing.

In this engraving a few overall dimensions are given and the set of guide bushings which are adapted to slip into the fixed bushings in the jig are also included.

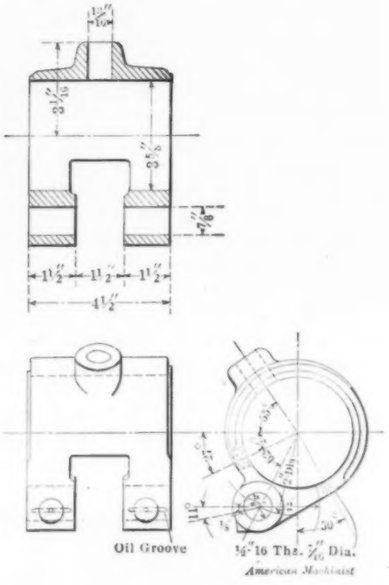


FIG. 7. CYLINDER YOKE FOR GEAR BOX

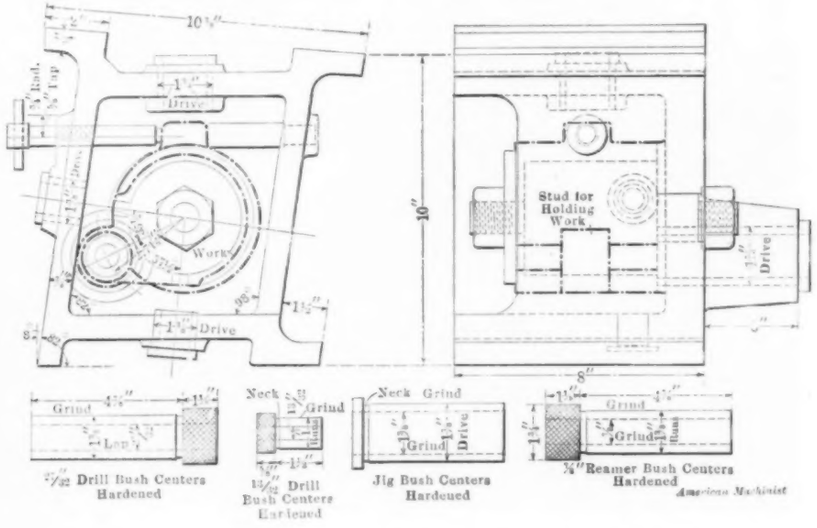


FIG. 8. JIG FOR DRILLING CYLINDER YOKES FOR GEAR BOX

Analyzing Foundry Cost Data

By L. W. Rawson*

How to use fundamental cost data to give cost of all important items per dollar paid to the molders and per 100 pounds of castings made. The application of these factors in determining selling price of castings and output per molder per day to pay the foundry expenses.

*Superintendent, the Washburn shops, Worcester, Mass.

Modern methods of manufacture require many divisions of labor or departments, and frequently these are entirely independent of each other. A close approximation of the exact financial standing of each of these departments at stated intervals is desirable and necessary, and should be obtained at least once a month. There is no department which requires such a financial statement more than the foundry, especially if the foundry conducts a jobbing business in addition to furnishing castings to the machine shop of the plant. Wherever the foundry is run in connection with a machine shop, the accounts should be kept entirely separate and castings charged to the shop at fixed prices, just as if they were purchased from outside. This separation of accounts will be found advantageous in working out any system of analysis.

In many plants the foundry is run especially for the accommodation of the machine shop and often the foundry has to suffer. In such cases the machine shop has every advantage in the way of price, and in many instances the price is very much lower than could be obtained in the open market. As this condition is certainly unfair it should, if it exists, be taken into account when considering a foundry report. To know the exact conditions every department should stand on its own feet; none should be favored at the expense of another. Therefore, the foundry should be allowed a price equal to that which would prevail in the open market.

Cost study for the foundry is a subject which has received and is receiving very careful consideration from those most prominently connected with the industry, and through the proper working and analysis of a cost system results will be shown in the economy of manufacture. Cost systems have to do with the analysis of the time required for certain operations, individual or collective, in the shop's production and are for the purpose of effecting individual economies. It is not the purpose of this article to enter into a discussion of cost systems, but rather to put forth such facts and data as will enable the management to obtain, within a close approximation, the exact standing of the foundry for a given period; and this without the necessity of taking any inventory whatever.

Every foundry should have on its books data sufficient for a general analysis of the various costs; if not, a start should be made immediately to obtain the facts and tabulate them. There is nothing which will show up existing conditions like tabulated facts, and with these made up from month to month as they occur the ever changing conditions can be readily noted, the causes ascertained and the proper remedy applied—and applied just where and when most needed. The simplest way of obtaining facts for tabulation is by keeping separate ledger accounts; the greater the extent to which this is carried the more data will there be to work on.

An Outline of Ledger Accounts

At the Washburn shops of the Worcester Polytechnic Institute, the following ledger accounts are carried and to these accounts are charged the various items as indicated:

Miscellaneous	Foreman
	Repairs
	Clean shop
	Lumber
Flasks	Rods
	Nails
	Labor
	Compound
	Flour
	Molasses
	Fuel for oven
Cores	Sand
	Rods
	Wire
	Chaplets
	Labor
	Vitriol
	Brushes
Cleaning	Stones
	Labor
	Sand
	Facing
Supplies	Plumbago
	Shovels
	Riddles
	Teaming sand
Teaming	Delivering castings
	Cleaning yard
Molding	Productive labor
	Coal
	Coke
	Clay
Melting	Firebrick
	Teaming coke
	Repair ladles
	Labor
	Pig iron
Pig iron	Teaming pig iron
	Labor piling
Scrap	Scrap iron
	Team scrap iron
Power	
Office	
Taxes Rent and Insurance	
Discount and Depreciation	

FOUNDRY ACCOUNT DISTRIBUTION

While these divisions are not all that might be made, nevertheless for ordinary purposes they are sufficient. In case any special work or repairs, or labor on equipment is to be made, it is better to open a ledger account to cover them so that the true cost can be obtained, as it can be transferred whenever desired. For instance, such an account might be the cost of fitting to a molding machine certain patterns belonging to some customer. The work is not done at the request of the customer but because it is believed by the management that it will result in sufficient economy in molding to warrant the outlay. If a separate ledger account is kept for this expense the exact cost is known and it is very easy to show whether or not it was a profitable investment. Moreover, the results thus obtained may be used as a guide for future undertakings.

The question as to which department, machine shop or foundry, should stand the cost of fitting patterns to the molding machine should be seriously considered by the management and the question settled for all time. Individual conditions must necessarily govern the decision. If the machine shop takes the initiative, demanding a better price for its castings, the machine shop should be charged with the cost of mounting and the pattern should belong to its equipment, while if the foundry sees the advantage in mounting and takes the initiative it should pay the bills and have the benefit.

As soon as the trial balance is obtained each month, the items are carried to a tabulated sheet (Table 1, figures furnished by an outside foundry) and the other data worked out from these figures. Thus we are able to compare each month with the preceding month and with the corresponding month of the previous year.

The Tabulated Data

The figures shown on the tabulated sheet are not the true financial standing of the foundry, but are tabulated for comparison. Thus the columns show the increase or decrease in pounds of castings made and their value and from this the average selling price per pound. If there has been a very marked increase or decrease in the average price per pound, a similar decrease or increase should show in the average weight produced by the molders, since the price per pound is usually made on weight, the price decreasing as the weight increases. If, however, this decrease or increase does not show relatively to the price per pound, then the cause should be ascertained. The action to be taken, of course, depends entirely on whether the facts are beneficial or detrimental to the financial standing.

One column shows the number of

heats, and the total pounds of castings made divided by the number of heats gives the average pounds per heat. Ordinarily nothing further is required of this except in times of business depression, when, if the average number of pounds per heat shows very low it might be well to take a heat every other day instead of every day. The average number of pounds per heat, however, does not always govern the number of heats, as the date of delivery and number of flasks in use in special work often overrule other considerations. The column showing the number of molder days is useful in that it gives us the average weight per molder. This, as has already been shown, will vary more or less with the average price per pound.

One of the most important columns on the sheet shows the average weight per molder. While this must necessarily vary with the different classes of work, with the average price per pound remaining practically constant any increase in the average weight per molder is sure to show increased profits and every foundry foreman should strive to increase this weight. From the total foundry pay roll and the amount paid per molder, we obtain the per cent. paid the molders. With the average price per pound remaining practically constant there should be very little variation in the per cent. paid the molder. Nevertheless, there should be a constant endeavor to increase this, for molding is productive labor and the rest of the pay roll is expense. Therefore, the greater the per cent. paid productive labor the greater will be the profits. With a practically constant average price per pound during some months the manager may be confronted with a lower "percentage paid molder." At the same time if the average weight per molder is satisfactory, in all probability the month will show a falling off in total pounds of castings made. This lowering of the percentage paid the molders would be accounted for by a lower number of molder days. This means that the volume of work has decreased and while a sufficient number of molders have been laid off to meet the changed conditions, a corresponding percentage of helpers and cleaners have not.

Again we have the conditions of decreased "per cent. paid molder," constant average price per pound with the average number of molder days, but with an increase in total castings made and an increase in average pounds per molder day. Unless the falling off in per cent. paid the molder is very great, it is perfectly legitimate. If at first thought it is considered to be detrimental the fact is that the increase in average weight per molder is sufficient to require more expense in the production of the castings.

There are many other deductions which can and must be made from the tabulated sheets from month to month, but already a sufficient number has been given to show their value.

Stock Castings

Many jobbing foundries have stock castings made from their own patterns, and these are used as filling-in jobs. Unless some account of this phase is taken, complications arise which throw out any advantage which can be obtained from the tabulated sheet and also any advantage obtained from the monthly balance. In the foundry it is impossible to ship all castings the same month they are made, but this usually takes care of itself as about the same weight is left uncharged each month. But in case stock castings are made, these should be carried in a column by themselves, with a column for the increase or decrease during the month. This column should be taken into consideration when the average figures for the month are compiled.

The Yearly Summary

Fig. 2 shows the summary for the year 1907, and is made up from the ledger accounts. As will be noted, the burden is taken as all the items of expense outside of molding, melting and iron, and these various items are worked out in percentage of the total, per dollar paid molder, and per hundred pounds castings made. The shrinkage and per cent. of pig iron and scrap iron are also given. From Fig. 1, the balance, $1080.39, which we will call the apparent balance, shows the balance from the book accounts. This does not show the true financial standing, for ordinarily there is a gain or loss in iron and supplies used during the month. The matter of gain or loss of iron is very easily figured as the total number of pounds purchased and sold is shown, but the matter of gain or loss in supplies cannot be ascertained without a complete inventory.

In order to arrive at the true financial standing, we resort to the use of the factors established from the business of the previous year (Fig. 2), or better, if the data are at hand, the average for the past three years. In making use of these figures, Fig. 2, for the factors, I prefer to use the burden in relation to the dollar paid the molder, as these items are all molding expense, while with the iron and melting the cost per 100 pounds of castings made is based on market prices for the month under consideration. We now have from the summary a cost of 1.084 for every dollar paid molder, and a cost of $0.127 for melting per 100 pounds castings made, a shrinkage of 9 per cent. and 49 per cent. pig iron and 51 per cent. scrap iron. With these figures used as factors, we are able to arrive at an approximate cost of the foundry for any month.

Date	Number Heats	Pounds Sold	Amount of Sales	Average Price per Pound	Pounds per Heat	Molder Days	Average Weight per Molder	Total Paid Molder	Total Pay Roll	Per Cent. Paid Molder	Total Purchases	Rent, Insurance, Taxes, etc.	Total Expense Purchases and Labor	Pounds Pig Purchased	Value Pig	Pounds Scrap Purchased	Value Scrap	Total Value Iron Purchased	Balance
January	24	301,595	$8,291.90	$0.02749	12,566	889	339	$2,164.61	$3,506.15	61.7	$477.54	$295.94	$4,279.63	215,040	$1,981.93	98,857	$950.01	$2,931.94	$1,080.39
February	22	260,257	7,215.92	0.02772	11,830	796	327	1,954.27	3,280.84	59.5	429.34	197.17	3,907.35	105,280	856.95	183,271	1,890.08	2,747.03	561.54
Total	46	561,852	15,507.88	0.02760	12,214	1,685	333	4,118.88	6,786.99	60.6	906.88	493.11	8,186.98	320,320	2,838.88	282,128	2,840.09	5,678.97	1,641.93
March	30	341,156	9,225.75	0.02703	11,371	1,058	322	2,609.63	4,289.66	60.8	434.13	192.85	4,916.64	174,330	1,595.17	164,736	1,678.79	3,273.96	1,035.15
Total	76	903,008	$24,733.63	$0.02739	11,881	2,743	329	$6,728.51	$11,076.65	60.7	$1,341.01	$685.96	$13,103.62	494,650	$4,434.05	446,864	$4,518.88	$8,952.93	$2,677.08

FIG. 1. TABULATION OF DATA SHOWING THE STANDING OF THE FOUNDRY

We know the exact value of the castings made during the month. Against this we must charge the value of the iron used, the cost of melting, the molding cost and all other expenses which we have grouped under the heading of burden. For example, we may take the month of January, 1907, and find that there were 301,595 pounds of castings made at a value of $8291.96. Using the figures obtained from Fig. 2, we find 9 per cent. average shrinkage and 51 per cent. scrap iron and 49 per cent. pig. From Fig. 2 we find the average cost of scrap to be $0.0096 and pig to be $0.00821.

Pounds castings made	301,595	
Average per cent. shrinkage	0.09	
Pounds shrinkage	27,144	
	301,595	
Total pounds iron melted, 51 per cent. scrap	167,657	
*Average cost scrap for January	0.0096	
Cost scrap used during January		$1,609.51
49 per cent. pig	161,082	
*Average cost pig for January	0.0082	
Value of pig used during January		1,483.56
Total cost iron for January		3,093.07
Pounds castings made during January	301,595	
Average melting cost per pound cast	0.00127	
Cost of melting for January		383.03
Molding cost	$2,164.61	2,164.61
Burden per dollar paid molder	1.084	
Burden for January		2,346.44
Total expense for month		$7,907.15
Balance		384.81
Selling value of castings made		$8,291.96

From the above figures it will be noted that the balance is $384.81, while the apparent balance from Fig. 1 shows $1080.39. Part of this difference may be accounted for in the iron, as 13,842 pounds less iron was purchased than was sold—this at the average cost, $0.934 per hundred, amounts to $129.20. The remainder would be made up in loss in supplies, etc., during the month.

The value of the balance shown by factors is readily apparent in that it is obtained for average conditions, while the apparent balance shown from the books varies above or below the true balance according to whether there has been an increase or decrease in iron and supplies during the month. At the end of the year, however, the apparent balance becomes the true balance after the adjustments are made for the increase or decrease in inventory over that for the previous year.

*In explanation of the apparent discrepancy in price of pig iron and scrap for the month under consideration, the pig iron was purchased on contract dated a number of months previous, while the scrap was purchased in the open market at prices then prevailing.

As previously stated, the reliance which can be placed on this method of figuring depends wholly on accounting for all the castings made during the month, and if they have been carefully accounted for, the result will be a very close approximation to the true financial standing for the month. Of course, it must be granted that conditions will vary from year to year, and that there may be marked differences between true conditions and the average conditions for, say, three years; but if such marked differences occur, they will be sure to appear in analysis shown by the tabulated sheet, Fig. 1, and again any differences which may occur should be on the right side if proper attention is paid to analyzing the facts as they occur.

SUMMARY, 1907

Division	Totals	Cost Per Cent. of Total	Cost per Dollar Paid Molder	Cost per 100 Pounds Castings
Miscellaneous	$4,324.31	4.7	$0.175	$0.123
Flasks	1,887.06	2.0	0.073	0.054
Cores	3,045.08	3.3	0.124	0.088
Clean	2,828.40	3.0	0.115	0.080
Supply	2,776.73	3.0	0.113	0.080
Office	6,441.89	6.9	0.262	0.184
Rent	2,455.71	2.6	0.098	0.070
Power	543.28	0.6	0.022	0.016
Team	2,029.42	2.2	0.082	0.058
Dep. and Res.	505.02	0.5	0.020	0.014
Burden	26,766.90	28.8	1.084	0.767
Mold	24,705.99	26.5	1.000	0.708
Melt	4,456.85	4.8	0.180	0.127
Iron	37,294.66	39.9	1.512	1.069
Total	93,224.40	100.0	3.776	2.671
Balance	3,428.49	3.7	0.139	0.098
Grand total	96,652.89	103.7	3.915	2.769

Shrinkage, 9.01%. Pig iron, 49.1%. Scrap, 50.9%.

FIG. 2. A SPECIMEN YEARLY SUMMARY

From similar figures it will be a very simple matter to arrive at a safe estimate for any new work, for the only data lacking will be the molding cost. Fortunately this is the one item on which nearly every foundry foreman is particularly strong, and by using good judgment in estimating the amount of good castings which can be produced there will be little likelihood of making castings at a loss.

AVERAGE NUMBER OF POUNDS PER MOLDER PER DAY

There is another example, the knowledge of which will be of particular advantage to every foundry, since it can be used as a daily check, and that is, what must be the average number of pounds of castings per molder day to pay expenses?

At an average selling price of 2¼ cents per pound, an average melting cost of $0.127 per hundred castings made, a shrinkage of 10 per cent. and a proportion of one-half pig and one-half scrap, pig iron being at, say, $18 per ton, scrap at 70 cents per hundred and all other expenses being $1.084 for every dollar paid molder, and the average price paid molder being $2.45 per day, what should this average be? As the shrinkage is 10 per cent. for every hundred pounds castings made will require 110 pounds iron to be melted. Pig iron at $18 per ton equals approximately 81 cents per hundred pounds. Of the 110 pounds iron melted, 55 pounds is scrap and 55 pounds is pig. At 81 cents and 70 cents, respectively, this amounts to $0.4455 and $0.385, or $0.8305, total cost of iron for 100 pounds castings, plus melting cost per 100 pounds of castings of $0.127, making a total cost of iron melted $0.9575 per 100 pounds of castings.

The average pay per molder is $2.45, and all other expenses equal $1.084 for every dollar paid molder, or $2.5758; $2.45 plus $2.5758 equals $5.0251, or total expense outside of iron per day per molder.

Let x equal number of hundred pounds per molder day, then $\frac{5.0251}{x}$ = total expense. Under conditions of the problem, find x, the number of pounds molded per day.

$$\frac{5.0251}{x} + 0.9575 = 2.75.$$

$$x = 2.83 \text{ or } 283 \text{ pounds.}$$

Therefore, under the conditions given above, the foundry must average 283 pounds per molder day to pay expenses.

If the conditions of the previous problem had called for an average selling price of 2 cents per pound, then the average number of pounds necessary to be made by each molder per day would have been 489. This shows that the necessary number of pounds increases more rapidly than the price decreases, owing to the fact that the iron melted costs the same in each case.

For cutting threads in copper or even steel, one of the best lubricants is common beeswax. Rub the partially finished threads with a lump of the wax and a clean thread will be cut, providing the tool is sharp.

Bearing Pressures in Gas Engines*

By G. W. Lewis and A. G. Kessler

Average maximum bearing pressures computed from empirical data used by American manufacturers in the design of horizontal and vertical stationary gas engines.

*Copyrighted by G. W. Lewis, 1911.

The following average maximum bearing pressures are computed from empirical data obtained from American manufacturers of stationary gas engines.

MAXIMUM EXPLOSION PRESSURES IN POUNDS PER SQUARE INCH OF PISTON FACE

Gasolene Engines

The average compression pressure of gasolene stationary engines was found to vary from 60 to 75 pounds gage, which gives a corresponding maximum unit explosion pressure of from 250 to 300 pounds.

Producer Gas Engines

In engines using producer gas (anthracite), the compression pressure was found to vary from 90 to 175 pounds gage, and the maximum unit explosion pressure from 300 to 400 pounds.

Natural Gas Engines

For engines using natural gas, the compression pressure varied from 80 to 150 pounds gage, and the maximum explosion pressure from 300 to 450 pounds per square inch of piston face.

The above values were furnished by manufacturers of the different types of engines.

In the following tables, the bearing pressures have been computed from explosion pressures of 250, 300, 350, and 400 pounds, and on the assumption that the explosion occurs when the crank is at the head-end dead center.

CRANK SHAFT BEARING PRESSURE

Horizontal Single-cylinder Engines

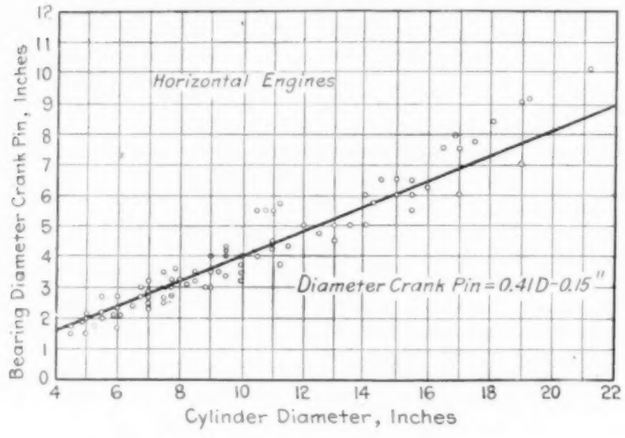
From curve I, the average relation between the cylinder diameter and the bearing diameter of the crank pin is determined. From curve II, the bearing length of the crank pin is determined in terms of the bearing diameter. Using the data obtained from curves I and II, table I was computed; it gives the average maximum unit bearing pressures for cylinder diameters of 4, 8, 12, 16, and 20 inches, on the assumption of maximum explosion pressures of 250, 300, 350, and 400 pounds per square inch of piston face.

Vertical Single and Multiple Cylinder Engines

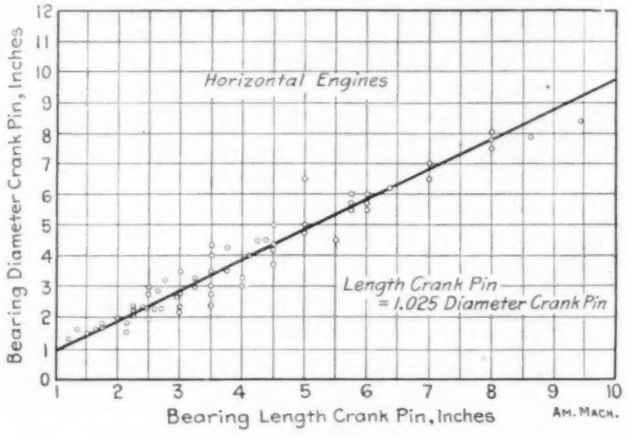
Curve III gives the average relation between the cylinder diameter and the crank-pin diameter. Curve IV gives the crank-pin diameter and the crank-pin length for vertical engines. From these table II was computed, with the use of the same cylinder sizes and explosion pressures as in table I.

COMPARISON OF PRESSURES ON CRANK PINS

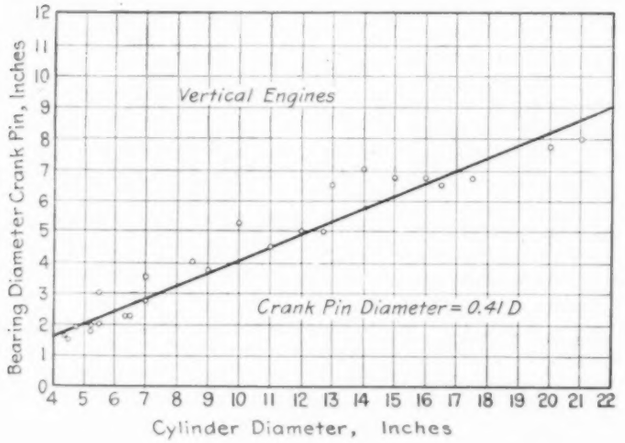
The comparison of the average maxi-



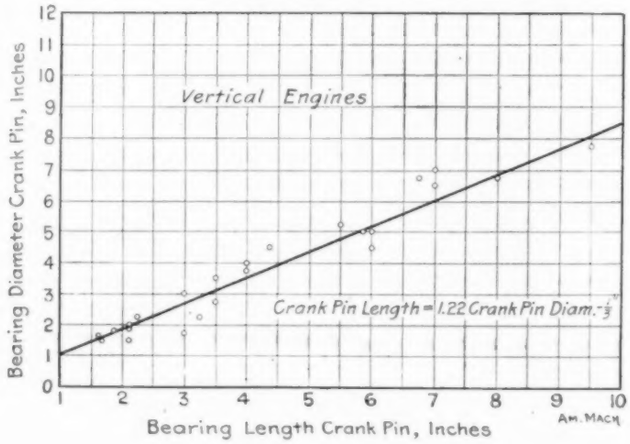
CURVE 1


Horizontal Engines
Length Crank Pin = 1.025 Diameter Crank Pin
Bearing Diameter Crank Pin, Inches
Bearing Length Crank Pin, Inches
AM. MACH.

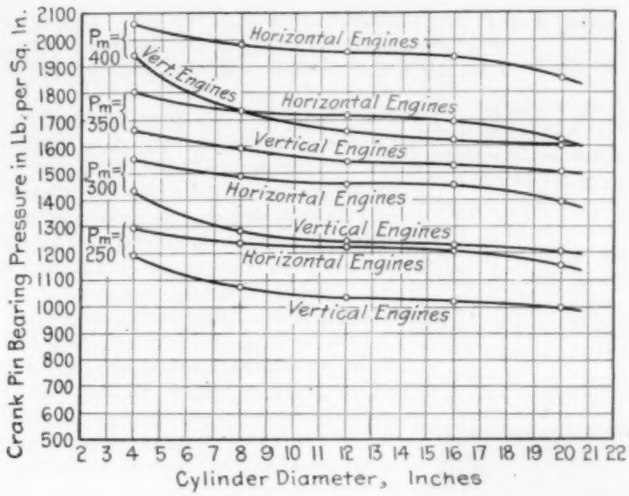
CURVE 2



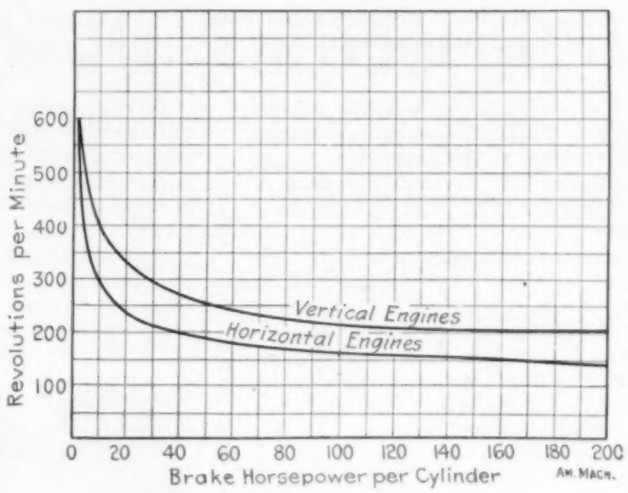
CURVE 3


Vertical Engines
Crank Pin Length = 1.22 Crank Pin Diam. - ½"
Bearing Diameter Crank Pin, Inches
Bearing Length Crank Pin, Inches
AM. MACH.

CURVE 4



CURVE 5



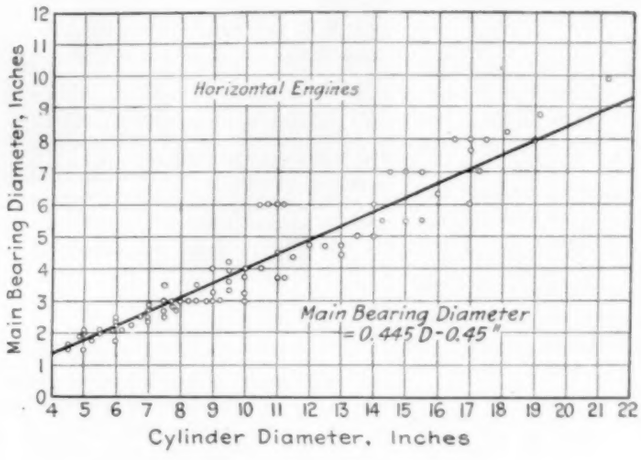
CURVE 6

mum units of bearing pressures on the crank pins of vertical and horizontal engines is best shown by curve V. As can be seen, the pressures in the vertical engines are considerably less than those in the horizontal engines. In comparing the tables, it also will be noted that the increase of projected bearing area in the vertical-engine crank pin is accomplished by increasing the bearing length and not the diameter of crank pin, as increasing the latter would increase the circumferential speed.

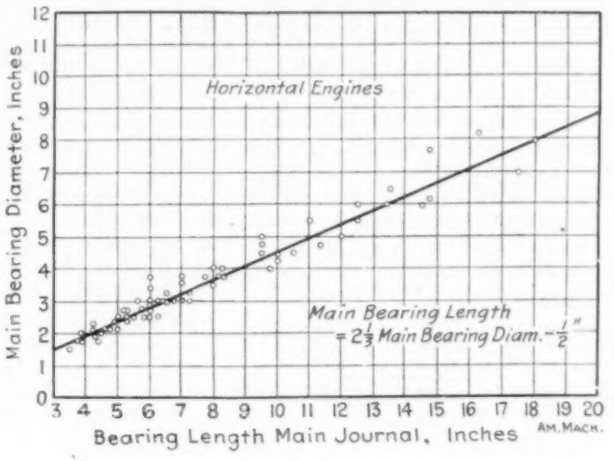
The reason for making the unit bearing pressure less in vertical than in horizontal engines is apparent from curve sheet VI, which shows the relation between the revolutions per minute and the brake horsepower.

FRICTION IN CRANK PINS

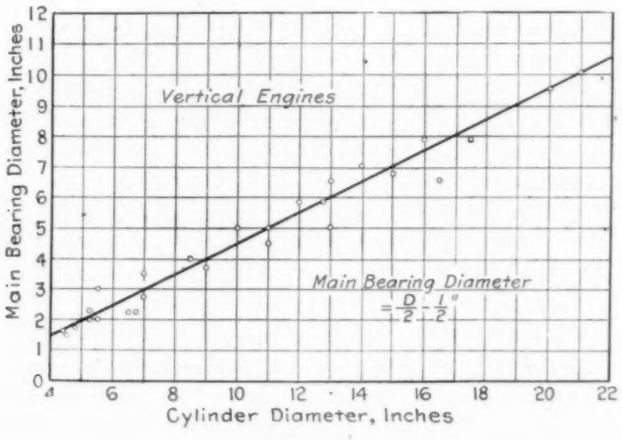
The work of friction in crank pins is about the same for both vertical and horizontal engines, as shown by the fol-



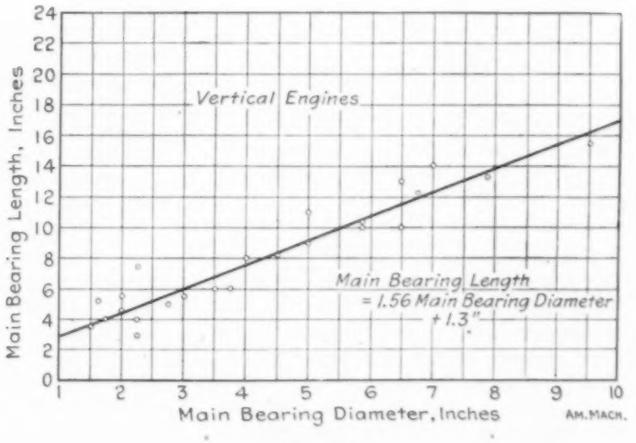
CURVE 7



CURVE 8



CURVE 9



CURVE 10

lowing table which is computed for one case from the following data:

	Horizontal	Vertical
D = cylinder diameter	12 inches	12 inches
D_{cp} = diameter of crank pin	4¾ inches	4¾ inches
L_{cp} = length of crank pin	4¾ inches	5¾ inches
R.p.m.	200	250
Maximum explosion pressure	300	300 pounds per square inch of piston face
Mean pressure on piston	20	20 pounds per square inch of piston face
Maximum unit bearing pressure	1450	1240 pounds per square inch
(Km) Maximum unit bearing pressure	98	81
(V) Circumferential speed in feet per second	4.15	5.3
Work of friction $V \times Km$	407	429 foot-pounds per second

AVERAGE MAXIMUM UNIT BEARING PRESSURE ON MAIN BEARINGS

Horizontal Single Cylinder Engines

Curve VII gives the average relation between the cylinder diameter and the main-bearing diameter. Curve VIII shows the relation between the main-bearing length and the main-bearing diameter. On the assumption that each of the two main bearings takes one-half the explosion load of the engine, and without the flywheel weights, table III was computed.

Vertical Single and Multiple Cylinder Engines

From curves IX and X, table IV was computed, showing the average maximum unit bearing pressure on the main bearings of vertical engines. In multiple-cylinder engines, the outside or end bearings next to the flywheels are often made considerably longer, from 1.5 to 1.75 times the lengths given in table IV.

AVERAGE MAXIMUM UNIT BEARING PRESSURE ON PISTON OR WRIST PIN

Horizontal Single Cylinder Engines

Table V was computed from data obtained from curves giving the relations between cylinder diameter, wrist-pin diameter, and wrist-pin bearing length; the relations are expressed in equations B and C, table V.

Vertical Single and Multi Cylinder

Table VI was computed in the same manner as table V from equations D and E. These show the relations between average cylinder diameters, wrist-pin diameters, and wrist-pin bearing lengths for vertical engines.

The question of employers' liability is rather unsettled, with a tendency toward self insurance in the case of the large companies and mutual insurance for those not so large. The American Car and Foundry Company is reported to be now carrying its own risk. It paid $700,000 in premiums last year and the injured men received $500,000.

Double Lathe Tool

BY W. H. SANDERS

The time-saving feature of this tool will appeal particularly to those who are required to turn out duplicate lathe work, in quantities, without the aid of the newer forms of turret lathes or other special machinery.

The holder is made of a steel block through which an oblong hole is made, either by milling a groove and making a cap piece, or by cutting through the solid

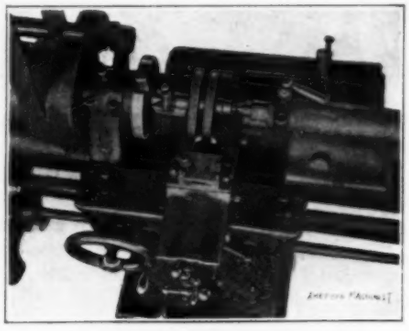


FIG. 1. FACING BOTH SIDES OF BLANK

stock, for the reception of the lathe tools.

Setscrews are provided both at the sides and top of the holder for clamping the tools in place. The holder has a boss on its lower side which fits into the slot in the cross slide, in place of the usual tool holder, and the whole fixture is held firmly to the slide by suitable bolts.

If the cross slide cannot be raised and lowered, the hight of the slot must be so regulated that the cutting edge of the tools will be nearly on the center of the work, and any slight variation may be made by placing liners under the bottom of the holder. Different shaped cutting tools may be made as the work may require.

Fig. 1 shows the tool set up for facing both sides of a gear blank at the same time.

If the diameter of the piece has already been turned, the points of the tools will not come in contact with scale and will retain their cutting edge and leave a smooth surface.

This tool may be used for many other similar pieces of work, and will be found very economical if many pieces are to be sized to the same width. The tools may also be shaped to form a square shoulder at the bottom of the cut, if so desired, and the diameter may be gaged by setting the stop on the slide.

Fig. 2 shows the tool when used for turning the periphery of round pieces.

In this, set up the cutting edges of the tools both facing the same way, and set the first tool so as to remove most of the stock, leaving only a few thousandths for the second or finishing tool to remove. It is obvious that with this arrangement successive pieces may be turned to exact diameter without changing the set of the tools so long as they remain sharp.

If too great accuracy is not required, the tools may be set very close together, and the two cuts taken at the same time, as, on account of the rigidity of the holder, the roughing tool does not seriously affect the finisher; but if the work be very accurate, the tools may be set so that the finisher starts to cut just as the rougher leaves the work.

This use of the tools has the advantage over the ordinary method of lathe work of not being obliged to set the slide for each piece, change arbors between roughing and finishing cuts, or stops to grind tools so often, on account of having a separate tool for each cut.

The only requisite is to have room between the faceplate and work for the roughing tool while the finisher is cutting.

Should three cuts be required, a third tool may be inserted in the center of the holder.

This tool has been found convenient

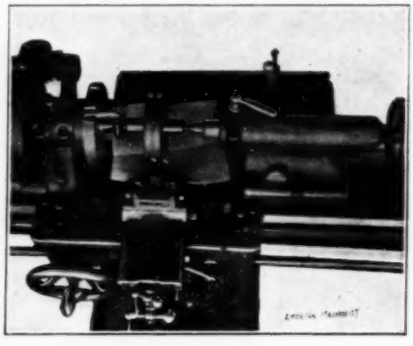


FIG. 2. TURNING PERIPHERY OF ROUND PIECES

and economical on many kinds of work, such as bushings, gear blanks, pulleys, etc., is not expensive to make, and it requires only a very short time to set it up.

It is only within a comparatively recent period that the question of cost began to force itself on the attention of engineering manufacturers; the older school were in the happy position of being able to satisfy themselves by a glance at their bankbooks that they were all right. It is to be feared, however, that those halcyon days have passed. Increasing competition and a diminution of the margin of profits, to say nothing of the necessity of minutely studying operations, have for some time passed made it imperative for manufacturers to look into the cost of their product, and it is probably quite true that the most successful firms are those who have looked into this cost most closely.

The Foreign Credit Department

By Archibald J. Wolfe*

There are four cardinal principles of foreign credit; Investigate thoroughly; grant no credit to a firm you would refuse if in America; avoid open credits; make cash discounts to your customers worth while.

*Chief of Credits Bureau, National Association of Manufacturers.

The expansion of foreign business leads naturally to the problem of a rational credit system applied to foreign risks. In many instances, particularly in the machinery trade, the exporting manufacturer cuts this Gordian knot by refusing to entertain the question of credits at all. But competition in the foreign markets is so keen that in many instances this is equivalent to resigning the field to manufacturers who will offer credit facilities to desirable customers abroad. Manufacturers of agricultural machinery, of sewing machines, of typewriters, even makers of wood-working machinery are already extending credit abroad. In a gathering of export managers listening to a lecture by our minister to a South American country, I heard admissions from representatives of firms, who had formerly held out against the granting of credits abroad, to the effect that a rational and liberal policy in this connection has been simply forced upon them, in order to keep their foreign business and to extend it. Having arrived at a safe method of handling foreign credits, they found the policy no more risky than the same one at home. Thus, it is beginning to be recognized that if a manufacturer grants credit at home, he can, under the observance of proper safeguards, grant credit abroad with equal safety.

Thus a new problem, that of foreign credit, is laid on the overburdened shoulders of the domestic credit man, who soon finds his judgment at sea when passing on a risk in Valparaiso, shrewd as it is when looking after the trade in Indiana or Maine. The domestic credit man is too busy to study the exigencies of foreign markets from the point of view of granting credit. It is better to have a special credit man conne ted with the foreign sales department as a special assistant for the foreign credit business. The profession of the foreign credit man as a necessary adjunct of the export department is, therefore, imperative in the evolution of doing business with foreign countries. The equipment of a foreign credit man consists of common sense, conservatism, knowledge of the line the house sells. In short, all of the qualifications of the domestic credit man *plus* an intimate knowledge of business conditions in the markets where his house endeavors to sell goods, a thorough familiarity with credit policies of competing countries in the markets concerned and why such a policy may or may not be imitated in his own case and, finally, a close acquaintance with the credit man's aids in foreign business.

It is the object of the present article to place before the foreign credit man in a concise and helpful fashion a review of some of the foreign credit man's aids.

Two Kinds of Foreign Credit

There are two kinds of credit which the foreign credit man will consider: The "open credit" and what may be termed "acceptance credit." The one-credit basis is the less satisfactory by far. It should be avoided if possible, and in fact never be adopted except in the case of customers thoroughly well known to the grantor of credit. Open credit is the kind of a credit a manufacturer extends to the customer at home. The goods pass into the possession of the customer and it is understood that at a certain time the bill will be paid. It is a most dangerous policy to pursue with foreign risks. The best customers abroad don't expect it and the others should not get it. Yet so keen is the competition of manufacturers of stationery goods, plumbing supplies, shoes, dry goods, hats and hardware for the trade of the nearby markets like Mexico, Cuba, etc., that they can now hardly sell in those markets at all except they grant open credits. The result is that unscrupulous customers buy a few hundred dollars worth of goods from one manufacturer, then lag behind in payments, start dealing with another manufacturer and so on until they have gathered many victims, or else they scrupulously maintain a good record with one manufacturer and victimize the rest.

By far the largest amount of foreign business is done on the basis of documents against drafts. That is, the bills of lading are turned over to the consignee's agents in New York or other American port, against acceptance of drafts. These documentary drafts are treated by all concerned more seriously almost than any other sort of commercial paper, for it is the attitude of the drawee to such drafts that determines his credit standing with the banks in the place of his residence. Many a customer who would feel no scruples in making the American exporter whistle for his money in the case of an open account would hesitate before committing commercial suicide in going back on his documentary drafts. Of course, every such method of doing business has its risks, for the banks discount such drafts with recourse. It is not so much the standing of the foreign customer as of the Am 'can creditor as the basis on which the bank cashes the drafts. This discounting is done "with recourse;" that is, in case the foreign customer goes back on his acceptances the American creditor must make good. In that case he will be out not only the goods, but also their value plus freight and expenses as figured in the draft originally discounted by the bank, and any interest that may have accrued.

Don't Do Business with a Foreign House without Investigating Its Credit

This brings us to the establishment of the one most vital principle in foreign credit, giving: Never do any business with any foreign concern without having thoroughly investigated its credit standing. Even where payment is made in advance or there seems to be no risk at all involved, do not deviate from this rule.

Kind of Statement to Be Exacted

The credit man looking after his foreign customer will make it his first business to exact from him a statement. It is very likely that he will encounter here his first snag. People in many countries are not accustomed to furnish statements. They are liable to consider such an inquiry an unwarranted intrusion. That is why furnishing credit information on many foreign countries is a vastly different problem from that of domestic information.

The request for a statement should be always addressed in the language of the customer, and should be accompanied by a form as follows:

Correct name of your firm:
Full address:.....(street).....
(town).....county.....
Names of partners:
Are you merchants?
Are you agents?
Are you manufacturers?
If so, of what articles?
Do you buy outright? Or on commission?
Wholesale? Retail?
Classes of goods handled:
Value of stock last inventory:
Capital invested in the business:
When established:
Who are your bankers?
Can you furnish confirmed bankers' credit in New York?
Through what commission house in United States do you buy?
References in your own country?
American references:
Cable address: Codes used:

FORM FOR SOLICITING FOREIGN CREDIT STATEMENT

If the customer refuses to return such a blank, the credit man will be very wise to ask for cash with order or for a confirmed banker's credit. If he, however, fills out and returns the blank the credit man will exercise a considerable amount

of discretion in judging it. The principal value of such a statement is in the data on which to base a further investigation. Figures as to the capital and stock are frequently apt to be exaggerated. Here and there the custom of the country will cause him to leave unanswered questions as to his capital and stock. This is not the worst omission. Such incommunicativeness argues a good deal better than the filing of a wrong answer. He may ever refuse to divulge his former sources of supply, which might call for some extra caution. In small towns in Mexico and Cuba many a risk, good for $200 or $300, is his own banker, so that he cannot give you the name of his bankers. But if he fails to give any *references* leave him severely alone.

Now all of the questions in the blank suggested above are intended to aid the credit man. They leave no room for superfluous verbiage which disfigures statements so frequently furnished through domestic agencies. The value of fixtures, etc., and a good many other details are of no consequence in foreign business. What a credit man wants to learn is whether the man pays his (*a*) foreign bills, (*b*) domestic accounts promptly. These questions should always be asked of concerns and banks given as references.

Use of American Banks with Foreign Connections

The foreign credit man will find it well to keep in touch with the American banks having offices abroad and with foreign banking agencies in New York City. Until the great Pan-American bank that has been so long awaited is open for business the International Banking Corporation, 60 Wall street, New York, must be considered as a unique illustration of banking facilities open to Americans abroad. We should have more such banks and in more foreign cities. The International Banking Corporation has offices in Panama, Manila, Mexico City, Hongkong and other places. It is always exceedingly courteous to American inquiries and is a great factor in extending American trade abroad. The Germans and the British have many more such institutions which are prepared to coöperate with the exporters in their own countries, than are at the disposal of Americans.

Among the countries which the foreign credit man is most frequently called upon to consider the Spanish-speaking countries are the most difficult to handle. It is advised, if possible, to sell in these countries against documentary drafts. If open credit is a matter of necessity in spite of warnings against such credit granting, have your customer give you clean drafts promising payment for certain periods. The difference between a clean and documentary draft is assumed as understood, but it may be repeated that documentary drafts are such as are given in exchange for documents, while clean drafts are ordinary drafts which pass independent of documents. The Mexican business man is proverbially slow in paying his bill. He is apt to find fault and to extort discounts to which he is not entitled. If a concern chooses not to pay a bill it is difficult to collect in Mexico, though perhaps not quite as difficult as in some other Spanish-American countries. Here a draft is very helpful. If unpaid when due it may be protested and the creditor is saved from the trouble of having to prove his account item by item, which is a very disheartening necessity in open accounts in Spanish-speaking countries, unless the debtor of his own free will acknowledges the correctness. Mexico is also overrun by Syrian traders (called Turcos in Mexico) who in general are exceedingly unscrupulous.

Cuba is a little better with regard to the regularity in the payment of open accounts. But here too drafts are preferred, and open accounts are discouraged in the minor places where there are no banking facilities.

In the West Indies it is very important to procure credit information before granting credit. There are here old established concerns which are thoroughly good, and minor concerns to whom it is risky and undesirable to sell on open account. In South America drafts against bill of lading are advised. It is very difficult to collect in Chile and Peru on open account, whereas drafts are practically safe with the usual precautions. In Brazil the banks are eager to finance transactions with desirable customers, and the business may be conducted practically on a cash against documents basis. It is advisable when drawing drafts on South America to make them out in pounds sterling, adding "payable at the rate of exchange of ———— bank's drafts on London" (insert the name of South American Bank). This will save quite a little money on each transaction, there being no draft exchange rate on dollars in South America. In China and Japan it is exceedingly risky to sell to small houses and great caution is advised. One should never sell a native Indian firm excepting for cash in advance. These small concerns do business in a patriarchal fashion and to do a foreign creditor is almost a work of God with them.

Principles of Foreign Credit

This survey is, of course, at the best a cursory one, but enough is indicated to aid the credit man, and in conclusion these foremost principles of foreign credit granting may be enumerated:

(1) Always investigate the proposed risk as thoroughly as possible.

(2) Do not grant credit to any firm whom you would turn down if it were located in your country.

(3) Avoid open credits wherever possible, and at the best limit them only to firms you have thoroughly reliable information about. Then remember that eternal vigilance is the price of safety.

(4) Make it worth your customers' while to avail themselves of cash discounts.

Cooperation vs. Dehumanization

By R. E. Marks

In these days when alleged systematizers are trying their level best to make a man into an attachment to a machine, who shall move his right hand 17½ inches and his left 13¼ inches, 57 times a minute for 17 minutes and then rest for 21 seconds, it is refreshing to find a business counselor who really believes that the man in the shop has at least an apology for a brain. And, more than that, who has the unalloyed nerve to say so at the present time.

I ran across a few circulars of a man named Leitch, in Cleveland, the other day, and one sentence struck me in a tender spot.

"There are enough brains outside of your private office to double your business." Then he goes on to say that his plan is to give the men outside the private office a chance to think, to encourage them in thinking and to make their thinking count in the progress of the business.

Of course, he is all wrong, for no one below a foreman or a "planner" has any thinks worth considering, and yet he has a few clients among some pretty big concerns. And they are free to acknowledge a good sized increase in business due to the building up of an intelligent organization instead of trying to keep all information away from them except what they need to sweep the floor or run a driller.

He does not claim to know all there is, to have any monopoly on a patent system, or to do everything for you. You have enough in your office and shop to do all there is to be done—but you do not know they are there because there has not been any way to bring them out.

There is not any iron-clad rule that will work in every place or that can be worked by every manager. Conditions and men alter circumstances. But if you get the coöperation of all hands and the office boy, you have made a start toward effective organization and team work that will work wonders in a few years.

And when the business doctors get to advocating coöperation in place of system, to recognizing that even the office boy may stumble on an idea that is worth while, there is hope for the rest of us.

A Test Indicator and Comparator

By Harry F. Atkins

A simple indicator, almost universal in its applicability. During a movement of one unit of space by the contact point, the indicating point moves 100; *that is, the ratio is* 1 *to* 100.

The indicator that I am going to describe is, to the best of my knowledge, new, and exceedingly simple.

The principle on which the whole contrivance depends is the magnifying of the movement of a plane surface, by transferring it to a roller held, by pressure, between itself and another plane surface that is a fixture, and causing the roller to swing a pointer over a graduated scale.

Fig. 1 is a diagrammatic representation of the device. *A* is the plane surface to which the movement to be indicated is transmitted from the plunger *B*. At *C* is the fixed plane. At *D* is the small roller that rolls between the two plane surfaces, and to which the pointer *E* is affixed. At *F* is the strong spring pressing the two planes into contact with the small roller, and also, by its inclination to the movement of the plane, causing the plunger to return after it is released.

It will thus be seen that the accuracy of its indications is dependent on the formation of a true cylinder and two true plane surfaces.

Of course, the pointer will not trace a truly circular curve, but will have a slight trochoidal motion; but this is so inconsiderable that it can be neglected entirely on the short arc that is used in this type of instrument.

The magnification obtained is as the diameter of the cylinder is to the length of the pointer, plus the diameter of the cylinder. This magnification must not be overdone, but 100 to 1 can quite well be obtained by disposing the planed surfaces at an inclination of 45 degrees to the path of the plunger transmitting the movement to be measured. To obtain a magnification of 100 to 1 it is only necessary to make the length of the pointer 70 times the diameter of the needle, Fig. 2; that is to say, with a roller ½ millimeter (0.019 inch) in diameter, a pointer will be needed about 40 millimeters (1.6 inches) long for a magnification of 1 to 100, which means that the whole contrivance can be gotten into quite a small compass.

In designing this instrument attention is called to the following points: All moving parts must be as light as it is possible to make them.

The friction at each point must be reduced to a minimum, excepting between the plane surfaces and roller, where it must be increased by the retaining spring.

The roller should be positively confined within the limits of its path, so that it can easily be returned to position should it ever be knocked out of place.

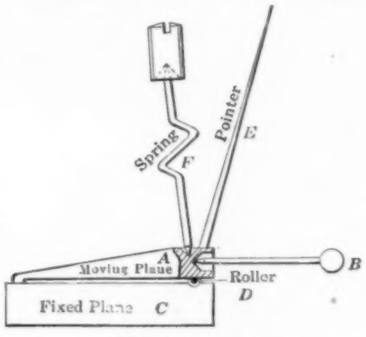


FIG. 1

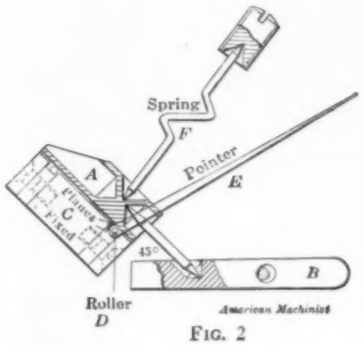


FIG. 2

A NEW TEST INDICATOR

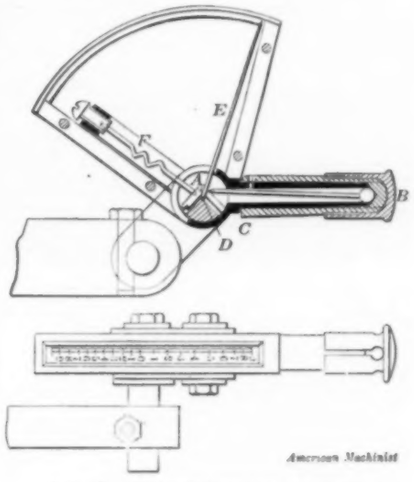


FIG. 5. CONSTRUCTION DETAILS

The friction is reduced, in Fig. 2, by adding an auxiliary roller, so that the spring acts between the two, or, in Fig. 1, by placing the spring very close to the rolling cylinder, and so causing a minimum of the pressure to be taken by the other end of the plane surface with its sliding friction; this is found in practice to be quite satisfactory.

It will be noticed that the retaining spring, which is in the elementary form of a sinuous wire, is nearly at right angles to the plane surfaces and slightly inclined. This divides its pressure into two directions, giving a very strong component holding the cylinder between the

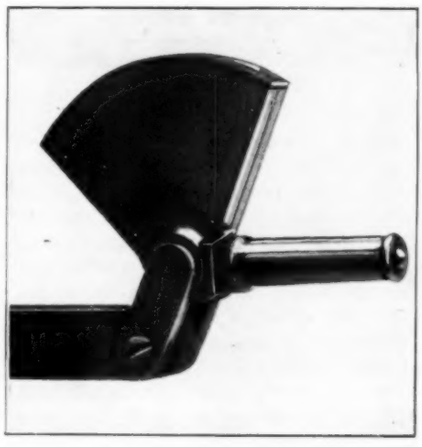


FIG. 3. THE INDICATOR IN TWO POSITIONS FIG. 4.

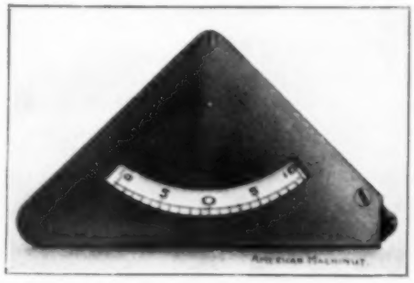


FIG. 6. ANOTHER METHOD OF LIMITING ROLLER MOVEMENT

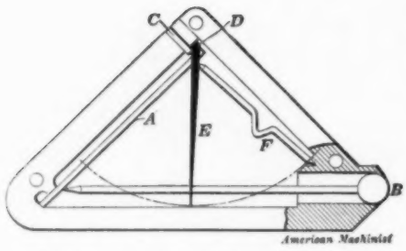


FIG. 7. SECTIONAL VIEW OF FIG. 6

two plane surfaces, and a very weak component holding the movable plane surface always against the action of the plunger. Thus the one spring serves a double purpose.

Perhaps the best way of positively limiting the movement of the rolling cylinder is to put a plate on each side and to extend it through holes in them. These holes require to be of a diameter equal to the diameter of the roller plus one-half the movement of the plane surface that it is required to indicate. Another method is to make the plane surface on the edge of a small plate equal in thickness to the diameter of the above hole, and to clamp it between two plates slightly larger than itself (see Fig. 2).

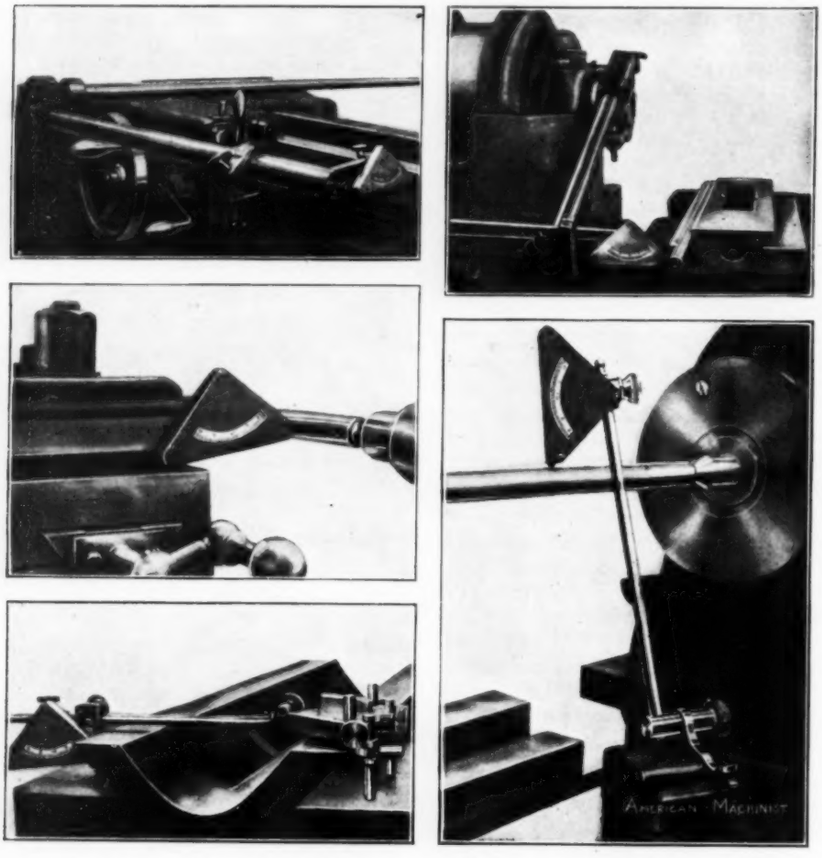
These constructional points will be more clearly understood, perhaps, from the illustrations given. Figs. 3 and 4 illustrate what might be called a general test indicator in two positions, and Fig. 5 gives the construcional details of such an instrument. This is carried by a shank suitable for securing in a tool post. It has a long nose to which the movement to be indicated can be applied at its extreme end in the line of its own axis, or in any direction radially at right angles to its own axis, thus enabling it to be used to test a hole as to its truth as well as for all the customary uses.

The construction should be clearly understood from the illustration. The nose itself is in the form of a sleeve fitting at its extreme inner end on the large part of a fixed taper nose, so that the outer end can have a slight lateral movement as well as one along its own axis. The inside of the outer end of this movable nose is formed into a 90-degree inclusive angle lapped to a finish. This angular part bears on a ball projecting from the end of the fixed nose, so that whether the movable nose is pushed directly against the ball, as when the thrust is in a line with its own axis, or whether it is pushed sideways on the ball, as when the thrust is radially at right angles to its own axis, the ball itself is pushed back into the bore of the fixed nose to exactly the same extent.

The motion of the ball gives motion to a light bar having its other end within the body of the Instrument. The end of this bar is formed into a plane surface at 45 degrees to its own axis, and this plane surface is held by the sinuous wire, in contact with the cylindrical roller, thus keeping the roller under pressure between itself and a fixed plane surface parallel to it. Each end of this roller is projected through a hole in a plate on each side of it, the holes being equal to the diameter of the roller plus its lateral movement.

The instrument as illustrated gives a magnification of 1 to 100, and has a scale reading ten thousandths either way. The pointer at its end is bent over a paper scale beneath a celluloid window.

This example shows the roller limited in its movement by extending it through a plate on either side.



FIGS. 8, 9, 10, 11 AND 12. INDICATOR IN USE FOR VARIOUS PURPOSES

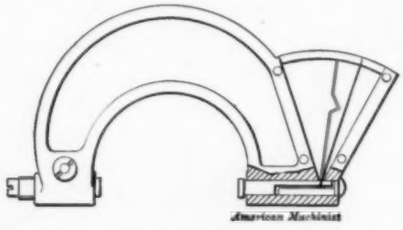


FIG. 13. SECTIONAL VIEW OF SNAP GAGE

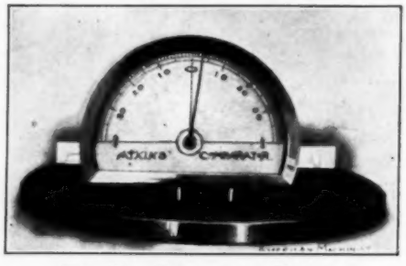


FIG. 14. COMPARING HOLES

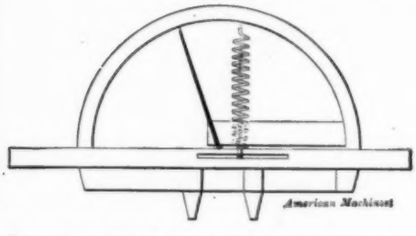


FIG. 15. SECTIONAL VIEW OF OPERATION SHOWN IN FIG. 14

Fig. 6 shows an example of the other method of limiting the movement of the roller. This example is also a general test indicator, but of a cheaper form and not so universal in its adaptations.

In this case the nose is done away with and the thrust is taken directly on the ball, into which a wire is fastened to actuate the sliding plane. The scale is on the side instead of the edge. This is a very cheap and useful form, and Figs. 8, 9, 10, 11 and 12 show it being used for various purposes.

Fig. 7 is a sectional view of this instrument, which is very easily made if

the body is formed from an aluminum casting, and is exceedingly useful in many ways.

In Fig. 8 it is being used to square up the saddle of a lathe with the bed.

In Fig. 9 it is being used to line up the headstock.

In Fig. 10 it is being used to set the head- and tailstocks in line.

In Fig. 11 it is being used as a surface gage, testing the relative hight of the lathe centers.

In Fig. 12 it is being used to parallel the ways of a milling-machine table.

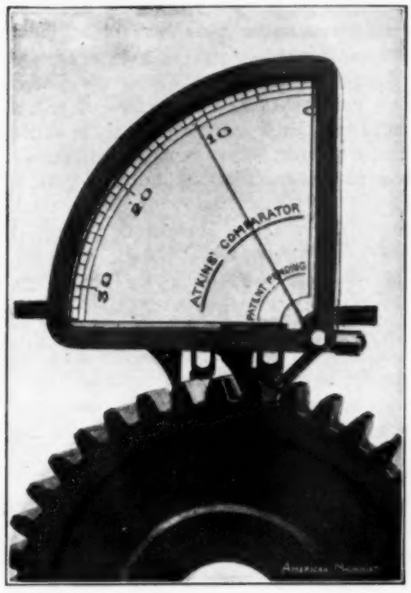


FIG. 16. COMPARING PITCH OF GEAR TEETH

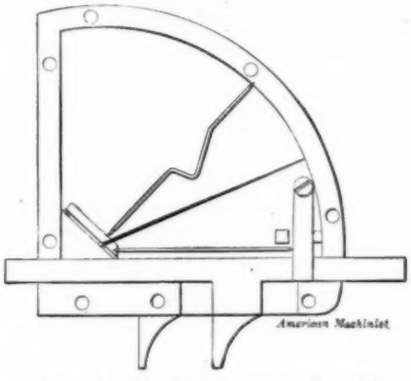


FIG. 17. CONSTRUCTION OF FIG. 16

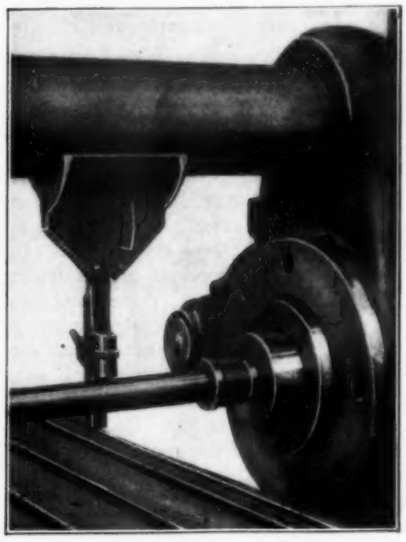
Fig. 13 shows its use as a snap gage.

Fig. 14 illustrates its application to an instrument for comparing the pitch of the holes in sector plates.

Fig. 15 gives a sectional view of this operation. Here it will be noted that the spring needs only to work in one direction holding the planes together on the roller, as the pointer need not return to zero each time. The spring acts in this case in tension instead of compression, so that when the conical points are pressed home, this pressure is added to instead of being subtracted from the pressure of the spring keeping the roller in place between the planes. In this instrument also the bar, forming the sliding plane and carrying the movable conical point, is capable of being adjusted beyond the range of the scale either way, so that a wide range is obtainable together with an open scale. The instrument, as shown, will compare holes of any pitch between ½ inch and 1¼ inches.

Fig. 16 shows an instrument built on this principle for comparing the pitch of teeth in gearing.

With the instrument as illustrated, too large a magnification was attempted, making the pointer too heavy for stability; so that on occasion the pointer would gain sufficient momentum to shift the roller unless very carefully handled. Otherwise it is quite a useful instrument. It should have been constructed as shown in Fig. 17, keeping the magnification within the limits already named.



FIGS. 18 AND 19. TWO SPECIAL OPERATIONS

Fig. 18 illustrates the application of the principle to a special instrument for testing the alinement of the overhanging arm with the arbor of a milling machine.

This instrument again has a wide range and an open scale, as the plunger bar is adjustable by pushing it through a friction collar beyond the limits of the movement of the pointer.

Fig. 19 is an illustration showing the application of the principle to a snap gage. On the scale of this one gage are indicated the allowances required for all the usual fits: force, press, standard, and running.

This is not intended to replace the ordinary fixed-limit gages for manufacturing work, but rather for use on odd work, where it will save an accumulation of gages on work requiring several fits of one nominal size, without requiring a micrometer caliper. It also has the advantage of indicating, when nearing size, exactly how much remains to be removed.

There are many other special applications of this instrument which suggest themselves, such as testing the cylindrical truth of a shaft, or ascertaining the error in the pitch of a given length of screw thread.

One might continue at length the list of its applications to special purposes, in many of which there seems nothing quite so suitable. It has already proved its utility.

New Development in Compressed Air Storage

BY FRANK RICHARDS

One of the most unsatisfactory features of compressed-air practice up to the present time has been in the inadequacy of the means provided for storing the air between its compression and its use, or for maintaining a full and constant pressure under a varying rate of consumption. It may be said that compressed air wherever employed, is always used more or less intermittently, and never at any constant rate except in cases where the entire output of a compressor of a large compressing plant is employed in a single water-pumping operation.

The air receiver usually provided with an air compressor has a total air capacity not exceeding the output of the compressor for a single minute, so that if the compressor stops or is slowed down to below the capacity to supply the consumption the pressure instantly begins to fall. To insure somewhat reliable maintenance of pressure and volume it is the practice to provide a maximum compressing capacity somewhat in excess of the maximum demand and then to automatically reduce the speed of the compressor as the rate of consumption diminishes. Even this arrangement usually does not completely satisfy the fluctuating requirements, and so we have various unloading or choking contrivances which will still more reduce the output without actually stopping the machine. However satisfactory the results thus obtained may be, it is evident that they are secured only by more or less complication of apparatus and a sacrifice of the essential conditions of power economy in the running of the machine.

A magnificent opportunity for the solution of this air-power storage problem

opened to the engineers of the Anaconda Copper Mining Company, at Butte, Mont., when it was proposed to find a cheaper means of driving their great mine hoists than by the use of steam. There were at Butte 25 large steam-driven hoists with an aggregate capacity of 40,000 horsepower, but the service required of the hoists was so intermittent, and the actual time of working of each was so short, that it was estimated that 4000 horsepower in constant operation would be sufficient for all the requirements, but it was imperative that the power should be always ready and always sufficient for each individual hoist.

The cost of steam had been about $80 per horsepower per year, while electric horsepower per year could be had for about $25. There were, however, serious objections to the adoption of the electric drive for each separate hoist, besides the enormous first cost of such an installation. Here, also, there could be no power storage, so that it would be necessary at times to have current available for nearly all the hoists at once.

So far as the steam hoisting engines were concerned, they could be adapted to the using of compressed air at comparatively slight cost, if only the power-storage problem could be solved, so that a constant drive of sufficient average capacity could be made able to take care of the peak loads whenever they should occur, even up to the running of all the hoists at once. The problem has been solved with a success and completeness seldom surpassed in great engineering undertakings.

It is not intended here to give more than the briefest sketch of the compressor installation and operation, the purpose being only to call attention to the air-storage scheme.

The electric current which drives the compressors is transmitted 130 miles from the new plant of the Great Falls Water Power and Townsite Company, at Rainbow falls, just below the Great falls on the Missouri river. There are three compressors, each with a direct-connected Westinghouse motor of 1500 maximum horsepower. The compressors, furnished by the Nordberg Manufacturing Company, are two-stage machines of the highest class, with low-pressure cylinders 50 inches diameter and high-pressure cylinders 30 inches diameter, and a common stroke of 48 inches. The combined free-air capacity of the three compressors I would estimate roughly at 20,000 cubic feet per minute (not knowing the builder's specifications as to speed, etc.).

The Air Receivers

From the compressors the air passes to the battery of air receivers. There are 32 of these, vertical, each 10 feet diameter and 30 feet high, their combined cubical content being, say, 70,000 cubic feet, which, at 90 pounds gage pressure, may be said to equal 500,000 cubic feet of free air, a volume which it would take the combined compressors nearly half an hour to compress and deliver. This is very different, to begin with, from the less than one minute capacity of the air receiver usually provided.

But the more important particular is that whereas in the established and familiar air-receiver practice, as soon as any air is withdrawn from the receiver in excess of what the compressor is delivering, or if for any reason the compressor stops, the pressure in the receiver begins to fall rapidly and constantly with the drawing of the air, it is as different as can be under the arrangement here being considered. Instead of a drop of pressure rendering the remaining contents of the receiver ineffective and useless, the pressure is maintained and the entire contents of the whole battery of receivers, including the original inert filling of air at atmospheric pressure, can be used at full pressure and effectiveness until the receivers are emptied. In practice the withdrawal of the air never goes as far as this. As these compressors run all day and all night, when there is at any time a simultaneous call for operating an unusual number of hoists, there is always the full capacity of the working compressors and also the entire contents of the battery of receivers to draw from until the unusual and excessive demand for air ceases. When there is such an unusual simultaneity of hoisting it is necessarily succeeded by a period when the hoisting and the demand for air are less than the compressor output, and then the receivers are automatically filled again.

How the Air Pressure Is Maintained

The device by which the air pressure is maintained in the receivers notwithstanding the diminution of the contained air is essentially a simple one. It is accomplished by the use of a standpipe or its equivalent, the same as in waterworks service. On a side hill at an elevation sufficient to give the required gage pressure of 90 pounds, there is an open water tank 100 feet in diameter and 15 feet deep. A depth of 10 feet in this tank gives a water capacity somewhat greater than the total cubic capacity of the battery of air receivers. As 2.3 feet of water gives 1 pound pressure, the mean elevation of the tank above the receivers should be $90 \times 2.3 = 207$ feet. There is a large pipe connection from the bottom of this tank to a horizontal pipe in free communication with the lower ends of all the receivers. No valves of any kind are required, and little, if anything, need be allowed for the friction of the water in the pipes, it being free to flow in either direction, according to the changes of the volume of air in the receivers. No safety valves are required, and it is impossible to produce any pressure in the receivers greater than that due to the head of water.

The compressed air as it is delivered from the operating compressors does not pass through the receivers, and, indeed, does not enter them at all except when the air production is greater than the consumption at the moment, when the surplus passes into the receivers, driving out and up into the elevated tank some of the water at the bottom of the receivers. When the call for air is greater than the compressor supply then the deficiency is made up by a flow of air from the receivers, the water from the tank displacing it.

The contact of the air with the water does not make it any wetter, as after compression it is quite certain to be saturated with water in any case. In the service for which this air is used, there is no call for "dry" air, as special means are provided for heating the air before it enters the hoisting engines, and moisture would be an advantage rather than otherwise.

Long continued records of the hoists as they had been run by steam made it possible to compute the compressor capacity required, and to adapt the compressors to the work so that they could be operated at the point of best economy.

The plant is unique as it stands, but in the use of the elevated tank it sets an example which we may expect will in time be widely adopted. For the maintenance of a constant air pressure with considerable storage capacity it seems to recognize and fill a long persisting requirement. The elevations which will give gage pressures of 50, 60, 70, 80, 90 and 100 pounds are, respectively, 115, 138, 161, 184, 207 and 230 feet. These hights can, of course, be secured as well by sinking the receivers as by elevating the tanks, or by a combination of both until the vertical difference is secured.

Twenty-five years ago the leading men of Germany became dissatisfied with the workings of employers' liability laws, because, like our statutes, they were wasteful, slow in operation and antagonistic to harmonious relations between employers and wage workers. Prince Bismarck was the prime mover in bringing about the reform. He realized that while the German government had exceptional powers to force arbitrary laws upon employers, it would not be wise to use this power autocratically. Instead of opposing employers, Bismarck conceived the idea of making them the very instruments for carrying out a novel scheme of compensation on scientific and efficient lines. As a result, the whole accident-prevention and compensation system of the German empire rests upon the shoulders of employers' associations, and these have succeeded under the supervising control of the government.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Gages Used in a Typewriter Factory

The types of gages described in the following article and shown in the illustrations are those in use in one of the largest typewriter factories in the country. In the factory referred to, all work is held to gage dimensions and for nearly all the several hundred separate parts entering into the machine a complete set of gages for each operation is provided.

Fig. 1 shows a shoulder screw with the allowable limits of variation, and Fig. 2

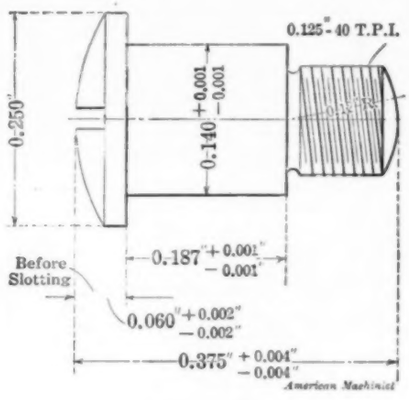


FIG. 1. SHOULDER SCREW

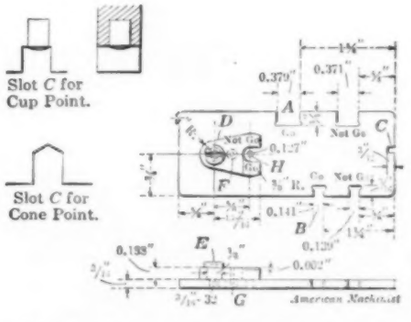
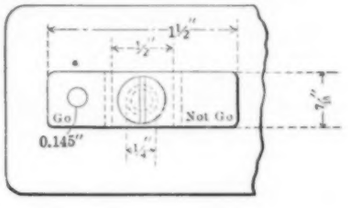


FIG. 2. GAGE FOR SHOULDER SCREW

shows the type of gage employed for the same. The gage consists of a flat piece of tool steel, hardened and ground, provided with various gage slots for the different dimensions. Blanks for these gages are carried in stock in several thicknesses and sizes, suitable for different-sized screws.

Referring to Fig. 2, slots *A* are the maximum and minimum sizes for the total length of the screw, placed on one side of the gage, and slots *B* are for the diameter of the shoulder, on the other side. On the end is a notch for gaging the point at *C*. As this particular screw is made with a round point the notch is made as shown, insuring the use of a tool with the correct radius. For screws with other style points the various notches shown at the left of Fig. 2 are employed. The device at the left of Fig. 2 is for gaging the length of the shoulder.



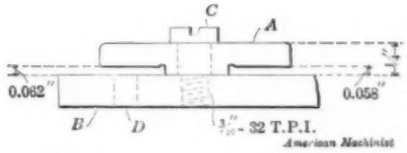


FIG. 3. GAGE FOR ROUND HEADS

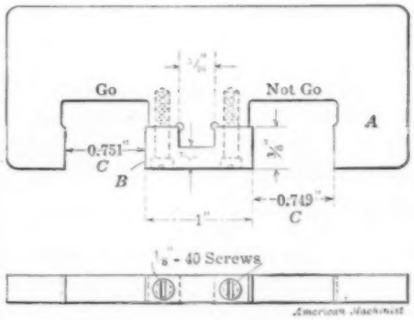


FIG. 4. FORM OF SNAP GAGE

The piece *D* is of tool steel hardened and ground, and swings on the pivot screw *E*, also of hardened and ground tool steel. A pin *F* on the under side of the swinging piece, projects into hole *G* in the gage. The hole is made large enough to allow just sufficient movement of *D* to right and left for the purpose intended. The screw to be gaged is dropped into the hole *H*, which is slightly larger than the diameter of the thread, and rests on the face of the gage. One side of the swinging piece is ground off to the "Go" dimension and the other side to the "Not Go." If the shoulder is of the correct length, the "Go" side will swing under the head and the "Not Go" side will not.

The finished gage is appropriately

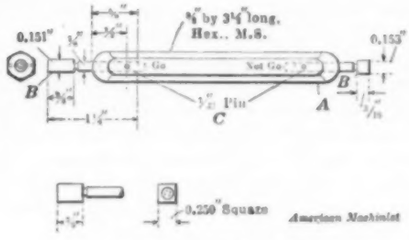


FIG. 5. FORM OF PLUG GAGE

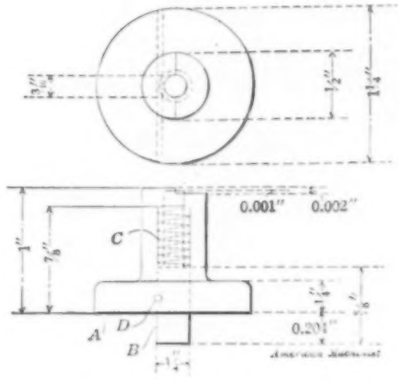


FIG. 6. FLUSH-PIN DEPTH GAGE

stamped with the part number, inventory number, size of slot in the screw, etc.

Fig. 3 shows a device employed when it is desired to gage the length of a round head, as on the screw shown at Fig. 1. With a flat head, simple slots in the body of the gage serve very satisfactorily.

Referring to Fig. 3, *A* is a swinging plate mounted on gage blank *B*, turning on pivot screw *C*. The screw to be gaged is dropped into the hole *D*, which is made a few thousandths larger than the diameter under the head. The distances from the under side of the swinging plate to the surface of the gage are made to the "Go" and "Not Go" dimensions, respectively, and one end of the swinging

piece should pass over the end of the head and the other should not.

Fig. 4 shows another form of snap gage in extensive use. This gage consists of a flat piece *A* of hardened and ground tool steel, and having a separate piece of tool steel *B* fastened to it by two ⅛-inch countersunk head screws. The two pieces are held in correct relation to each other by the tongue and groove shown. The advantage of this form of construction lies in the ease of altering in case the distances *C* are to be changed. It is only necessary to provide a new piece *B* in case the slots are to be shortened.

Fig. 5 shows a plug gage for the diameter of drilled or reamed holes. It consists of a handle *A* of hexagon machine steel, in each end of which is inserted a detachable plug *B* of tool steel, hardened and ground and the ends of these plugs are finished to the maximum and minimum diameters of the holes. These plugs are secured in the handle by a small pin *C*, permitting easy removal in case the plug is to be renewed through breakage or wear. These gages are also made with square-end plugs, as shown in the lower corner of Fig. 5, for gaging the width of milled slots.

Fig. 6 shows a flush pin limit depth gage largely used for gaging the depth of holes and slots. *A* is a machine-steel pack-hardened holder of sufficient width to straddle the slot containing the flush pin *B* of hardened and ground tool steel, and the spring *C* of light piano wire. The pin *D* prevents the flush pin from falling out. A movement is allowed the flush pin of 1/32 inch each way.

In the particular example chosen, the depth of the slot is 0.204 inch, with an allowable variation of 0.001 inch each way. The top surface of the holder *A* is ground off on one side 0.002 inch below the other side, and the flush pin *B* is ground so that when the end that enters the slot projects 0.204 inch from the bottom of the holder, the top end will be exactly halfway between the two surfaces of the top. If the de th of the slot as milled is within the allowable limits, the top of the flush pin can be felt by aid of the finger nail to project above the low surface on the top of the holder, but not above the high surface. If the slot is too deep, the flush pin will project above the high surface, and if too shallow, below the low surface.

Pittsburg, Penn. T. H. PARK.

Method of Recording Grinder Wheel Speeds

In observing wheel performances it is quite convenient to have at hand the speeds of all the various machines in the group that is being observed. These speeds can be tabulated on a blank page of the foreman's pocketbook and he can readily refer to this in making his observations.

The accompanying table 1 shows a table I made of the wheel speeds of a certain group. The constants that appear next to the wheel speeds (revolutions) are given to save trouble in calculation. The peripheral speed in feet is obtained by multiplying the wheel constant by the diameter of the wheel in inches; the constant can be reckoned to the nearest ten in making a mental calculation, as this is sufficiently accurate for all practical purposes.

Besides this table, which is for the use of the foreman only, a separate table for each machine of the precision type should be made, and this table should be hung adjacent to the particular machine, so that it is immediately available for reference either by the foreman or the operator.

Machine	1st Speed		2d Speed		3d Speed		4th Speed		5th Speed	
	Revolutions	Constant	Revolutions	Constant	Revolutions	Constant	Revolutions	Constant	Revolutions	Constant
Landis (small)	2650	690	2260	590	1900	500	1570	420	1300	340
Birch	2250	590	1700	445	1400	370	1100	290		
Landis (medium)	1680	440	1400	370	1120	290				
Reinecker surface	1360	360	1190	310	1030	270				
Reinecker surface	1160	300	1020	270	880	230				

To obtain speed in feet multiply constant by diameter of wheel in inches.

TABLE 1

CYLINDRICAL GRINDER, LANDIS — A 20 / 66

Cones	1st	2d	3d	4th	5th	6th	Wheels: Size	Wheels: Shape
Revolutions of wheel	1680	1400	1120				14″x1″x5″	Landis 77
Wheel constants	440	370	290					
Internal attachments:								
Constants for No. 1	4840	4070	3190				⅛″x¼″x¼″	24 W.
Constants for No. 2	3630	3050	2390				⅜″x¼″x¼″	35 W.
Constants for No. 3	2900	2440	1910				1½″x¼″x¼″	89 B. & S.
Constants for No. 4	2080	1750	1370				2″x¼″x¼″	Special
Revolutions of work	305	195	135	85	55	30		
Work constants	80	50	35	22	14.4	8		
Feed per revolution of work	11/16″	7/16″	1/4″	1/4″				

TABLE 2

A typical example of a table of this kind is shown in Table 2. The table contains the wheel speeds and constants; the working speeds and their constants; and also the constants for the various internal-grinding attachments. These latter are especially necessary as difficulty is very often met with in choosing suitable wheels for these. A table of this kind takes little time to compile; it saves an immense amount of time and precludes the mistakes that are made frequently when recourse is had to the memory. Furthermore, I believe that if such a table is placed at each machine, it will stimulate the operator's interest in the wheel performances and the possibilities of his machines.

W. G. GROOCOCK.

Plumstead, England.

Some Suggestions for Junior Draftsmen

I have frequently noticed that the young draftsman who is serving, or has just finished, his apprenticeship, usually is anxious to acquire technical notes and data which will offset his lack of mathematical training. This young man who has been unable to acquire a college education, turns to his Kent or Haswell, and, buried in formulas and stresses and strains, tries to amass for himself a fund of useful information. He reads but does not master; he wades through the golden rules of drafting but does not retain; and he finally finds himself dependent upon his textbooks for data which should be a part of his own working knowledge.

Some years ago, at the suggestion of my chief draftsman, I secured possession of every copy of the AMERICAN MACHINIST as soon as the office had finished with it. I culled the choice articles, formulas, and instructive data, grouped the clippings into folders and filed them. My folders bore the following titles: Gearings, belts and chains, jigs and fixtures, properties of metals, shop kinks, and foundry practices.

I arranged the folders in a letter-file box. At intervals I had a house cleaning and weeded out the clippings that memory and familiarity had taught me to be less valuable, and those which had become obsolete.

Another aid that a young draftsman often neglects is that of catalogs. A problem presents itself pertaining to a chain drive; the vital points are surface

speed, length of drive, wear and cost. From either the "American Machinist Handbook" or the several chain catalogs every question is answered. A good idea also is to get the catalogs of the competitors of the firm for which you are working, and gain information from these by comparing them.

Taunton, Mass. B. M. NOSREME.

An Interesting Shaper Job

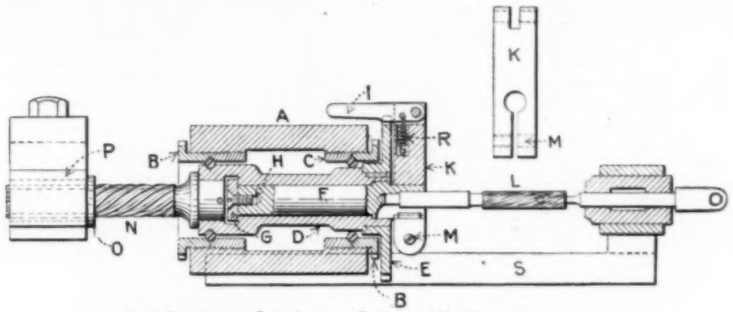
Some time ago I received an order for a large number of screws and nuts with octuple threads. These screws were 5⅛ inches long, 15/16 inch in diameter, 2 9/16 pitch, and a high degree of accuracy was required in making them. If the order had been for only one of these screws, with nut, it could have been made on the lathe and for a large order it would have paid to make milling cutters for the purpose. Since, however, there was no suitable miller available, I constructed the shaper fixture shown in the accompanying cut.

A cast-iron plate *S* was made with two bosses for bearings, the larger one to hold the drive for the screw that I wished to thread; the smaller one to take the headstock of the fixture. The larger bearing *A* has fine threads in both ends into which are screwed an outer ring *B* and an inner ring *C*, which are grooved to form ball bearings in which turns a hardened-steel sleeve *D*. The rear bearing has to sustain the entire thrust in working, and during the return of the ram, the front one acting only as a guide for the sleeve *D*. On the front end of this sleeve is keyed a disk *E* with eight notches in the circumference, which is equal to the number of threads of the screw that is to be cut. The spindle of the fixture is held at the rear end by the disk *G* attached by screw *H*, and turns freely in the sleeve *D*, allowing the head to be indexed when desired.

The piece *K* is keyed to the front end of the spindle *F*, so that both must turn together, both the piece *K* and the spindle *F* being split so that when the end of the screw blank *L* is inserted in the front end of the spindle, it can be clamped by tightening the screw *M*. At the rear end of the sleeve *D* the double-threaded screw *H* is driven into *D* and fastened by a conical pin. The lead of the thread of this screw is the same as that of the screw which is to be threaded. Over the double screw *N* runs the nut *O*, which is fastened in the casting *P*. This casting is bolted to the guides of the ram which is run far enough out to allow of this being done.

The motion of the ram causes the nut *O* to travel on *N*, and produces the desired revolution of the spindle *F* and with it the work, the cutting being done by a tool in the regular tool block, the tool being lifted as the ram returns, to avoid damage.

After one thread has been cut, the head *K* with the spindle *F* is indexed one notch and the next one finished.



Longitudinal Section of the Attachment.

Front View Rear View

AN INTERESTING SHAPER JOB

With this fixture any other number of threads can be cut, if the lead be not too small, by substituting for the index plate *E* one with the proper number of notches. The lead of the thread can also be changed by substituting a different lead screw *N* and nut *O*.

Dresden, Germany. W. DOHRN.

Air Pressure Breaks Windows

At a certain foundry a positive blower is used to supply draft for cupolas. It is located in a separate closed room, 12x 16 feet, which has three glass windows 3x6 feet. The door is kept locked so that nobody can go into the room to loaf. The windows were the only way the room could be ventilated. One day the windows were closed tight. The man who had charge of the blower turned it on, and thinking everything was all right, locked the door and went back to his work.

In a short time there was a crashing of glass and everybody thought a terrible accident had happened. The man quickly opened the door and to his amazement the three windows were on the floor, all in pieces.

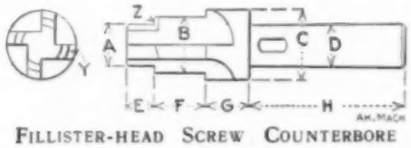
After the blower had run a little while it produced a vacuum in the room; hence the windows were simply sucked in.

Toledo, O. W. H. WOLFGANG.

Fillister Head Screw Counterbores

The accompanying figure shows the design and proportions of counterbores for countersinking the heads of fillister-head screws. The pilot, of course, is the size of the body of the screw. The cutting diameter is the diameter of the screw head plus an allowance, thus: 0.004½ inch for the ⅛-inch screw, and increasing to 0.015 inch for the ¼-inch size. The depth *H* is equal to the depth of the head plus an increasing amount for increase in size, to bring the head well beneath the surface and allow for grinding the counterbore.

Note that edge is not relieved; in fact, it is well to remove the sharp edge to be sure that it will not cut. This shoulder acts as a stop, which gives holes of proper and uniform depth. The relief should be filed as shown at *Y* and *Z*, and, when dull, these counterbores may be ground on the front face. No grinding is necessary on the outside diameter, as the sizes are not of sufficient accuracy to require it.



FILLISTER-HEAD SCREW COUNTERBORE

A	B	C	D	E	F	G	H
	0.192				0.155		
	0.255				0.240		
	0.382						
	0.445						
	0.572						
	0.635						
	0.760						
	0.825	1					
	0.888	1¼					
	1.015	1¼					

DIMENSIONS OF FILLISTER HEAD SCREW COUNTERBORES

The cutting diameters and depths of these counterbores were figured from tables in the "American Machinist's Handbook." They have given good results in practice, and produce holes of uniform depth without loss of time in setting stops and measuring depths.

Buffalo, N. Y. ARTHUR F. KUNZE.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Decimal Sizes for Wire

In his article on page 113, Mr. Osborne brings out some very excellent points, but I think that he has not the right idea as to the best procedure to accomplish results. Of course, the method he suggests would work out, but it would entail such expense to the manufacturers and such delay as well as confusion to the purchasers that I hardly think it would be justified. To have any hope of success it behooves us to advocate as simple and efficient a plan as possible.

I heartily agree with Mr. Osborne in decrying the extreme refinements one so often sees in catalogs where the decimal equivalents are carried out to nine places. I also doubt the possibility of such accurate measurements; but granting that they are possible, they certainly cannot be practicable in everyday use. Hence, why burden ourselves with them? Some two or three years ago the Association of American Steel Manufacturers issued a circular letter in the form of a small pamphlet on the subject of substituting decimals in the place of numbered gages. The pamphlet covers the ground quite thoroughly, and offers a very practicable and simple solution of the question. It suggests that no sizes or thicknesses of standard materials be changed, and that the sizes or gages at present in use remain unchanged, the only change advocated being that they be designated by decimal dimensions instead of numbers. For instance: No. 5 rod M. & W. gage will be described as 0.207-inch rod; No. 6 United States standard plates will be described as 0.203-inch plate, etc.

That this suggested change will necessitate no alterations, as far as the manufacturer of the product is concerned, and that some of the leading manufacturers of these products are members of the association should preclude opposition from the manufacturing side.

The association further advocates that when calipering materials, micrometers or other gages reading only to thousandths of an inch be used; also, that not more than three significant figures should be used, thus eliminating the extreme refinements shown by the fifth or sixth decimal place. According to this recommendation, No. 21 United States standard will be known as 0.034 inch instead of 0.034375 inch; No. 8 United States standard will be shortened from 0.171875 inch to 0.172 inch.

This change, however, should not affect such articles as screws, nails, rivets, or any finished article known to the trade by size number. Exception is also made for sheet iron, or sheets lighter than ⅛ inch thick, which should be described either by their weight per square foot, or by the legalized United States standard system.

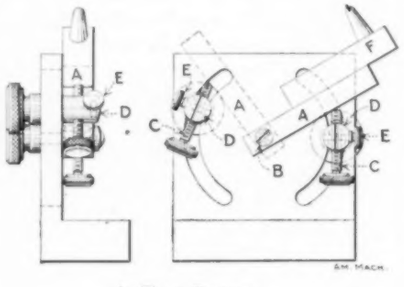
Concerted action on the part of the manufacturers and users of wire, sheets, etc., is the only thing that will bring about any betterment of the system now in use.

If every concern interested in these products would discontinue the use of the numbered gages in referring to the thicknesses on all their requisitions, drawings, correspondence, invoices, etc., there is no doubt that the change would come about easily and naturally. It is, indeed, such an easy change to make, and it would be such a practical, thorough, and complete cure for the ills of arbitrary gage matters that it is difficult to see what valid objection could be raised against its adoption.

Pittsburg, Penn. EVERARD BROWN.

A Device for Truing Surface Grinder Wheels

Having seen G. E. Gay's device for truing surface-grinder wheels, on page 1125, I am reminded of a device for the same purpose which has been in successful use in our shop for some time and



THE DEVICE

for which I believe we can claim some advantage over the one shown.

We use the device on a magnetic chuck, but it can be clamped to the table as well.

The bar *A* is a piece of hardened and ground tool steel, and swings on the stud *B*. It is adjusted to the correct angle by the screws *C C*, these being held tightly in place in the split studs *D D* by the small thumb screws *EE*. The diamond is mounted on the square piece of steel *F*, which slides in the corner made by the bar *A* and the back of the fixture; *F* is pushed back and forth by hand. The top of the fixture being ground, it forms a convenient surface on which to set the protractor when setting the bar *A* to accurate angles.

As the bar swings on a stud and the location is held by the screws *C C*, two angles on the same wheel may be dressed and redressed without changing the setting.

As the diamond is not clamped to the fixture, it can be used between times for free-hand dressing of the wheel, rounding corners, etc.

As the diamond can be used at the extreme edge of the fixture on either side, any angle can be dressed on the inside of the wheel (which I should judge would be impossible with Mr. Gray's device.

As there is neither a closely fitted slide nor oil, we have not found it necessary to protect the fixture in any way.

The above fixture has been in use for two years in grinding many different shapes of vertical forming tools. It has not been repaired in any way and has given perfect satisfaction.

Windsor, Vt. K. H. CRUMRINE.

Was the Mechanic of the Old School Better?

In his article "Responsibility for Good Work," page 1132, Volume 34, Mr. Kunze questioned the superiority of the mechanic of former years to the mechanic of the present day.

The man of the old school deserved a great deal of credit for having brought about the position of our younger mechanics of the present day. Of course, the mechanic of today has the advantage of a better technical education; at least this is offered to him by the work-shop and technical schools that have been established and are still developing. These did not exist at all 30 years ago. But in spite of his better education, I think that the mechanic of today would have a great deal of difficulty in duplicating some of the work that was turned out or completed, say, 20 years back.

Methods are changing so rapidly nowadays that it is difficult for the mechanic

to keep up with the procession. These changes in methods have brought about a great deal of elimination of hand work. The old mechanic was an expert at this. Present-day methods do not require the same refinement of touch, for the machines are made responsible for the accuracy of the work, rather than the operator. As a case in point, let me refer to the ease with which most of our hardened machine parts can now be made, as compared with the old-time hand work.

Industrial Education

In discussing my article "Industrial Education," page 33, E. H. Fish seems for some unknown reason to have interpreted it as trained directly at him. As I said at that time, the article was too brief to properly discuss such a broad question; hence I mentioned only a few of the more important features with the object of starting a good honest discussion in a valuable paper like the AMERICAN MACHINIST, in order to create, if possible, a more general interest by manufacturers in these schools.

The industrial schools of Massachusetts are doing good work and if Mr. Fish had read my article to the end he could have seen that it was not a criticism. It is perfectly right and just for these schools all over the country to work out their own individual problems in order that the product of the best school may be used as a basis in deciding what will finally constitute the best method of instruction.

NAME OF THE SCHOOLS

Mr. Fish says if these schools are trade schools why not say trade, and he is right. But can these schools teach a trade? It seems to me there is a vast difference between teaching a boy a trade and preparing him to enter a trade. It may be that Mr. Fish does not interpret the meaning of the word trade as I do. To me, teaching a boy to run a lathe or any one machine does not make him a journeyman, but does make of him a specialist. I believe a boy will make a better specialist if he can get training on all the machines in the school equipment.

While in conversation with a large manufacturer the other day he made this statement: "There are a great many good machinists in the country today but there would be a great many better machinists, if they, when boys, had worked a year or two in the foundry." This has been my experience and I believe the boy when he enters the trade, even if he does nothing but run a planer for the remainder of his life, will run that planer better and will be of greater value to his employer and himself if he has had the right sort of training on the miller, driller, grinder, lathe, boring mill, turret lathe, and planer, and his training will have been so thorough that instead of being a "half-baked mechanic" he will be well fitted for his place in the productive world.

TEACHING A TRADE IN A SCHOOL

In my article on page 460, a mistake made a certain sentence read: "I doubt if there is a manufacturer today who will give a boy who has served his full school apprenticeship journeyman's wages." The word "shop" should have been used instead of the word "school," and I repeat what was intended at that time, "I doubt if there is a manufacturer today who will give a boy who has served his full shop apprenticeship," meaning a commercial shop, "journeyman's wages" unless he is an exceptionally bright boy or is running a special machine.* Until the manufacturer refutes this statement I shall certainly believe that he thinks the shop cannot make a journeyman out of the boy in the old way. While, on the other hand, as I said in my previous article, I believe a "Preparatory Trade Institute," while it will not be able to teach a boy a finished trade, will present to the manufacturer a boy who will be 100 per cent. better than the boy trained under the old method of apprenticeship. This will not be a discredit to the school but a great credit, for the flexibility of this training will be such that the employer can use the boy when or wherever he pleases, especially if business is a little slow and he wants to put him on another machine. There is another side to this question. Until every foreman, every superintendent, and every manufacturer decides that a piece of work shall be handled by every mechanic in exactly the same way, the instruction given the boy should be very carefully and judiciously considered, for if his instruction is limited to the one-man idea he will be placed in a very disagreeable position, since when he enters the trade he will find that no two foremen do a piece of work in exactly the same way.

Mr. Fish says, "In one instance only, I agree with Mr. Haight." However, I can find him agreeing with me all through his article, for in discussing this feature he makes practically the same statements; namely, "The school building should be of mill construction. There should be an abundance of work of all grades; the instructors should know their trade, and the work must pass the inspection of outsiders." I felt there could be no argument against these statements and I am glad to know that I have such a strong advocate in Worcester. The Worcester school is fortunate in having only one reason for pupils not staying through the course; namely, some short-sighted manufacturer will not wait for the fruit to ripen before he picks it. The New Bedford school has to face this problem but this is not the principle reason why pupils do not finish the course. A number of parents place their boys in school and later find that circumstances compel them to take the boys out of school and put them to work. In cases of this kind we have found that our method of all-round training has increased considerably the economic value of these boys and our record shows that they are all doing much better work and holding better positions than would be possible without this training.

*The New York Central lines give graduate apprentices full rate at once, finding them better than many journeymen who are hired in from outside.—ED.

SECOND-HAND MACHINERY

Mr. Fish regards it as an imposition to set a boy at work on second-hand machines, "but if there is any time when a boy should be made to do accurate work it is the first day he is in the shop." I have seen a great many men who had been helpers in several shops try to "throw a bluff" by representing themselves to other firms as accurate machinists, but every foreman I ever knew, myself included, was able to "size them up" within an hour or two and give them their "walking papers." This being true of men it seems to me to be far from a square deal to stand a boy up in front of a machine and ask him to do accurate work before he knows the difference between a lathe and a blacksmith forge. Now here again is where Mr. Fish agrees with me, for he says the rebuilding of second-hand machinery is one of the best things that boys in the second or third years of the course can do. Rebuilding, not patching second-hand machinery, is the work of the second-year pupils in the New Bedford school, and the work of the third year is building new machines, and these advanced pupils work on the best machines that money can buy but not so many of them that in nine cases out of ten the expense would, unless met by some philanthropist, prohibit the establishing of these schools. The Massachusetts law is not a temptation but a "God send" and the number of boys between the ages of 14 and 16 it is keeping off the street, out of bowling alleys, and other similar harmful places is remarkable. In the two years we have been operating in New Bedford not one cent except for machine oil had to be used in the upkeep of the new machines, for the pupils in using second-hand machinery were taught not only how to avoid all danger points, but that a lathe or grinder is a delicate thing even if it is made of metal. They take great pride in trying to excel each other in these essentials.

TRAINING OF TEACHERS

In classifying the requirements of a good shop instructor, Mr. Fish shows

that he knows what he wants, but is not quite clear as to how he can get it. If he will apply to Brown & Sharpe, or any other equally good firm, I think that he will find men with 10 years' shop experience, who, if given adequate inducement, would drop everything and go to the proper training school where they may be taught the art of teaching. Or, if he will apply to me, I will give him the names of 20 men with adequate shop experience who have said: "If I only knew how to teach these, schools would be the place for me." These men know their trade and it is not necessary for them to get shop practice in a training school, but practice in teaching, and it may be that one year in such a school would suffice. But this training is only necessary in order to get the first good instructor; then the school should do its own training, and this is what the New Bedford school is doing now.

Choosing a Trade

Mr. Fish knows that there are four departments, including the academic department, in the New Bedford school, and that three of these are power, machine work and wood work. He also knows that there are several related trades taught within these departments. He is right when he say's the boy's father on the average seems to want him to do something different from what he does himself, and the boy is apt to make a poor choice. This being true, it is up to the school to give him an opportunity to try out in each department, and not compel him to learn a trade that a competent instructor will know within a short time that he never will be able to work at with profit to himself or his employer. The New Bedford school, because of its several departments and related trades within these departments, gives the boy this opportunity with the help of the instructors to find himself. Of course, instructors all over the world have to run the gantlet of what the older boys may say of him, and if he lets this interfere with his efficiency, he is not onto his job. This trying-out process, as any of our boys can testify, is work and not play.

Commercial Product

Until it is proved conclusively that second-hand machinery is not the best for the new boy, I must, basing my opinion on past experience, maintain that it is the best, and the boy will be better trained because he has worked on these machines and later on the best that money can buy. At this point in Mr. Fish's article there seem to be two contradictory statements: (a) "If we build a lathe for ourselves it means that someone else does not build it for us and the employer does not make his profit nor the employee get his profit for making it." (b) "I do not believe that the total school output in any city or district can ever be of sufficient magnitude to have a real influence on either wages or profit." I agree with (b), for it seems to me the fact that the total output of these schools not being sufficient to ever affect wages or profit would indicate that the boy could not get the required machine practice necessary to teach him a trade. But does the manufacturer want us to teach these boys a trade or does he want us to give them, as I said previously, a flexible training, in order that he may not be limited to the hard and set rules of any one man?

As to (a) I believe in installing second-hand machines for the green boy; the initial cost will be within the limit of almost any city. There will be more of these schools established, creating a great demand for this sort of machinery that there are manufacturers willing to meet this demand in order that they may make room for modern tools, that these tools must be purchased from other manufacturers and later these schools must purchase some new machines, for their product will not keep pace with the enrolment, and because of the above reasons the machine manufacturer will have three new markets in which to dispose of his product, his profits will increase, he must employ more men, and as these men "go down the grade of physical strength," he must go to the schools for new material.

It does not seem to me that this is the time to take the "bull by the horns," and I feel sure that Mr. Fish in another article will give for the benefit of those interested a clear and concise outline of the work in Worcester, for I believe he is doing his best to meet the demands of local conditions. The inauguration of this work in the educational world is a serious problem, and I believe it will be to the best interest of these schools if there is coöperation all along the line, for this is getting to be a very swift world, so swift, in fact, that I doubt if the majority of manufacturers have any time to devote to apprentice boys, and I feel that if this work is given in industrial schools on a plan similar to that suggested by me the public will get a good return for the money invested.

Blanketed Patents

I have been much interested in an article, on page 161, entitled "Blanketed Patents." The question I would like to raise is: How is it (or rather, why is it) possible in this late day for such a condition of affairs to exist? What are our patent examiners paid for? Why is it that they will allow patent after patent on the same device, simply because the wording of the claims is different? In the face of W. S. Schuyler's claim—which is basic—how have they the face (I believe that is the proper word) to dupe a hundred or more poor inventors out of the patent fees and aid in enriching patent sharks all over the country?

For several years I had occasion to examine new trolley devices that were offered by inventors. There were several ideas in connection with a device to prevent a trolley wheel from leaving the wire—two devices in particular that had been patented so often and brought to my attention so many times that I got to thinking of them as "standardized patents." Think of it! And I will gamble that the patent office will continue issuing patents on these same devices for years to come. The great majority of the patentees of these devices had probably never had a good look at a trolley car, and had no idea of what was in use and what had been patented. When applying for their patent they were probably notified that certain claims interfered with claims already granted, and their lawyer, therefore, modified these conflicting claims to avoid such interferences. In other words, he makes the patent "harmless."

Why should the inventor be compelled to make a search of the patent office, and how can he without ample funds? What is the patent office for? How can the Government issue a patent that is not a "real" patent? How can the examiners help but know that it is of no value? Take the case referred to in Mr. Kimball's article. No one could again make the claim quoted as it is basic. Surely, it is the business of the patent examiners to know this. Then why in the name of common sense do they issue further patents on the same device? We all appreciate that the patent office has an enormous proposition on its hands, but there is something wrong with the system.

An article appearing in the *English Mechanic and World of Science*, of July 21, 1911, page 563, entitled "The Decadence of the British Inventor," hits the nail on the head. If the article gives the conditions existing in England, how much worse off are we? According to this article: "If the inventor is a man or firm of small means, and if the funds of that company are not sufficient to put in action our scandalously expensive machinery of justice, the patent is not worth the paper it is written upon.

"So far as the majority of inventions are concerned the patent laws of this and, in fact, nearly all countries, are a fraud.

"Of all the mean, contemptible practices to which the state has been addicted, there is nothing meaner or more contemptible than the system of so called patent protection under which governments have swindled and ruined some of the most valuable members of the community."

Charles H. Logue.

Pittsburg, Penn.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

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Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For July,* 1911 *(American weekly, American monthly, English weekly and German weekly), total,* 111,250.

Of this issue 22,750.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 133

American Machinist

Stock Distribution to Employees

Under date of July 15 the Union Switch and Signal Company, of Swissdale, Penn., announced to its employees a stock-distribution plan to encourage them to become stockholders in the company. Two thousand shares of the capital stock of the company were set aside and 1000 of these were made available for immediate subscription. A recent letter from Col. H. G. Prout, general manager of the company, states that already the allotment is considerably oversubscribed.

The following privileges were offered: Subscriptions will be received at the price of $75 per share from all employees except directors and general executive officers. If the employee's annual compensation is $1000 or less he has the right to subscribe for not exceeding five shares. If the annual compensation is $3000 or less, he has the right to subscribe for five shares for the first $1000 of compensation, and for one additional share for each additional $250 of compensation or fraction thereof. The maximum subscription in this class is 13 shares. An employee whose annual compensation exceeds $3000 has the right to subscribe for 13 shares for the first $3000 of compensation, and for one additional share for each additional $500 of compensation or fraction thereof. The maximum subscription in this class is 20 shares.

If the purchaser desires, payment for this stock can be made in regular monthly instalments covering a maximum period of 50 months; that is, a monthly instalment of 2 per cent. Cash dividends accruing on this stock are credited to the purchaser's account after 24 per cent. of the total price of the stock purchased has been paid in cash by the purchaser.

Employees who remain in the company's employ after receiving payment for the stock purchased under this plan are entitled to receive and retain "nontransferable participation certificates." Through these certificates the purchaser secures substantial profits in addition to the regular dividends paid to other stockholders. These additional profits consist in the payment of a participation dividend of $5 per annum for a period of five years. This is in effect a repayment of one-third of the purchase price of the stock, thereby eventually reducing the actual cost of the stock to employees who remain with the company to $50 per share.

After the stock is fully paid the purchaser can receive, if he desires, a regular stock certificate, which can be sold and transferred, in place of these participation certificates which are nontransferable. To hold a participation certificate the employee must remain in the employ of the company.

In case of death or disability the rights of subscribers who have not completed payment are fully protected, and provision is made for suspension of employment. This plan has been worked out with a great deal of care by the officers of the company, and they are confident that it will be to the lasting advantage of the corporation and its employees. The help given to the employee is substantial. The individual payments that he must make are small and are spread over a long period—about four years. If he chooses to remain in the employ of the company, the cost of the stock can be still further reduced by the return to him of a certain part of the purchase price through the participation profits. If he is obliged to give up his subscription for any cause before payment is complete, his money is returned with current interest.

The stock of the company is now selling on the Pittsburg exchange for about $86 per share. Thus the entire plan has the ear marks of a good bargain for both parties. That the employees believe it to be such is abundantly shown by the fact that the allotment is already oversubscribed.

Factory Ventilation

The interest in factory ventilation is shown by the numerous bills introduced into State legislatures during the past winter and spring. In general, the requirements for the amount of air supplied per hour per individual or its quality compared with the surrounding exterior air have not been specifically defined, but have been vaugely stated and the entire matter left to the discretion of some official.

The bill introduced in the New York legislature, however, was very definite in its provisions, as shown by the following quotation. This bill was not voted upon in either the senate or assembly.

"A workroom shall be deemed to be provided with sufficient means of ventilation if provided with means of ventilation which will supply constantly in all parts of the room air, either of the quality or in the quantity hereinafter prescribed. A workroom shall be deemed to be properly and sufficiently ventilated if the air in the working parts thereof does not contain more than nine parts of carbon dioxide in 10,000 volumes of air in excess of the number of parts of carbon dioxide in 10,000 volumes of the exterior air, or if there is constantly supplied throughout the interior of the room at least 1200 cubic feet of air per hour for each person therein present and employed, and in addition thereto at least 1000 cubic feet of air per hour for each cubic foot of gas burned per hour, such air to be taken from an uncontaminated source; provided, however, that if gases, fumes, vapors, fibers, dust or other impurities are generated or released in the course of the business carried on therein, the room must be further ventilated by providing at the point of origin of such impurities proper hoods and pipes by and through which such impurities shall be collected and removed, and such pipes and hoods shall be connected to exhaust fans of sufficient capacity and power to remove such impurities and such fans shall be kept running constantly while such impurities are being generated or released."

Furthermore, the temperature for workrooms was fixed as follows:

"And provided further, that the temperature in any factory workroom, except a boiler room, shall not exceed 72 degrees Fahrenheit, as determined by the wet-bulb thermometer, unless the temperature

of the exterior air exceeds 70 degrees Fahrenheit, as determined by the same process, in which case the wet-bulb temperature of the workroom shall not exceed that of the exterior air by more than 5 degrees."

These quotations indicate clearly the definite nature of the provision of this proposed law in contrast to the vague and indefinite provisions of most existing laws.

In Massachusetts a new bill provided for an unpaid commission of five members, having the power to appoint and discharge, fix terms of office and adjust salaries for a chief commissioner, two deputies and 50 inspectors, 10 of the latter to be women, this commission to have charge of the administration of a compulsory-ventilation law.

Other States, whose legislatures have considered this subject during the past few months, are Illinois, Indiana, Nebraska, Wisconsin, Kansas and North Dakota. Most of this legislation, both proposed and enacted, referred to school houses and public buildings, with some provisions applying to factories and mills, but not framed with the definiteness of the New York bill.

Photographs as Criteria of Illumination

One of our correspondents has questioned the value of photographs as criteria of illumination. We quite agree with him that photographs have their limitations in showing the merits of a system of illumination, but at the same time we think that good photographs furnish excellent means for judging most of the important features. The question of how far one can go in basing his judgment upon a series of photographs resolves itself into a consideration of the different factors that enter into the illumination and of how truthfully the camera expresses these factors. The reader will probably grant:

1. That a good photograph gives one a fair idea of the intensity of the light, and also shows whether the units are so placed that the light falls in the proper direction for the various employees.

2. That the photographs show whether the lamps are so placed as to furnish a uniform light over the entire working surface.

3. That to some extent, the glare of a lamp can be judged by a photograph.

4. That the method of wiring can be observed.

Of course, no judgment can be made of color effects, or of the quality of the light by means of photographs, but four of the most important elements of illumination can be judged fairly well by means of these.

A photograph has its limitations, but it must be granted also that there are limitations to the actual observation of an illuminating system; it is only by making actual tests and experiments that the effects of a lighting system can be definitely determined. In the last issue, we published an article on shop-lighting design, which we think bears out the point that photographs are good criteria of illumination.

New Publications

RAILWAY-SHOP KINKS. Compiled by Roy V. Wright. Published by *Railway Age Gazette*, New York. Two hundred and ninety pages, 9x12 inches; 803 illustrations. Price, $2.

This is a compilation from the pages of the *Railway Age Gazette*, under the direction of a committee of the International Railway General Foremen's Association, and consists of a large variety of railroad-shop kinks, which have been contributed to the paper named, by railway mechanics from all over North America. These include methods and devices for doing all sorts of railway repair work to both locomotives and cars, and gives the name of the shop and road in which the kink is used. It is difficult to see how any railroad-shop man can fail to secure many times the value of the book in useful information, while many of the ideas can be easily adapted to suit conditions in other shops.

ELECTROPLATING. By Henry C. Reetz. Ninety-six 4½x6½-inch pages; 62 illustrations in the text; indexed. Popular Mechanics Company, Chicago, Ill. Price, 25 cents.

This little book belongs to the *Popular Mechanics* Handbooks series, and is intended as a short treatise both for the beginner and for the more experienced electroplater. Its 11 chapters give the principles of the art of electroplating, describe the equipment necessary, tell how to clean articles before plating, and how to plate with copper, nickel, silver and gold, and ends by giving three pages of aids for burns and poisoning such as platers may be subject to, and a few very general business suggestions. The use of extreme care is vigorously emphasized, as shown by the following quotation: "Use care at every step. Nowhere is carelessness more costly than in the electroplating shop. Constant vigilance is the price of success."

Personals

William McIntosh has been made foreman of the erecting department in the Lackawanna shops at Scranton, Penn.

A. H. Tuechter, president of the Cincinnati-Bickford Tool Company, Cincinnati, Ohio, has returned from an extended European trip, on which he combined business and pleasure.

L. S. Scott, formerly superintendent of the Ingle Machine Company, of Rochester, N. Y., has assumed management of the James Fitt Machine Company, Inc., of Rochester, N. Y.

A. H. Wheatley has resigned as manager of the Brooks works of the American Locomotive Company, in order to accept a similar position at the Kingston plant of the Canadian Locomotive Company.

W. D. Creider has resigned as superintendent of the plant of the Pressed Radiator Company of America, at West Pittsburg, Penn., to become superintendent of the works of the Duff Manufacturing Company Pittsburg, Penn.

F. A. Bicknell, for several years in charge of the drafting department of the Wells Brothers Company, of Greenfield, Mass., has resigned to take up his duties with the Bicknell-Thomas Company, recently incorporated.

T. G. and T. W. Meachem have been elected president and vice-president respectively of the recently reorganized Palmer-Moore Company, Syracuse, N. Y. The Messrs. Meachem hold similar positions, in reversed order, with the New Process Raw Hide Company of the same city.

Gano Dunn, for some years first vice-president and chief engineer of the Crocker-Wheeler Company, has resigned from that company in order to accept an important engineering and executive position. Mr. Dunn will sail shortly for Europe to attend, as president of the American Institute of Electrical Engineers, the meeting during the Turin Exposition of the International Electrotechnical Commission, to be held on September 7, 8 and 9, and also the following meeting of the International Electrical Congress.

Franklin B. Shuster

Franklin B. Shuster, president and treasurer of the F. B. Shuster Company, New Haven, Conn., died at his home in New Haven, on August 14.

Mr. Shuster was born at New Haven, Conn., May 10, 1866. He took up the machinist's trade with John Adt & Son, leaving there to become foreman of the machine and tool department of the New Haven Clock Company. Later he was for about six years with Wilmot & Hobbs Manufacturing Company, now the American Tube and Stamping Works of Bridgeport, Conn., in charge of its machine- and tool-designing departments.

On the death of John Adt in 1895 Mr. Shuster purchased the business and in 1898 the F. B. Shuster Company was incorporated. Mr. Shuster invented and patented many new machines and tools and under his guidance the business enjoyed a continual growth. He is survived by his wife and one son.

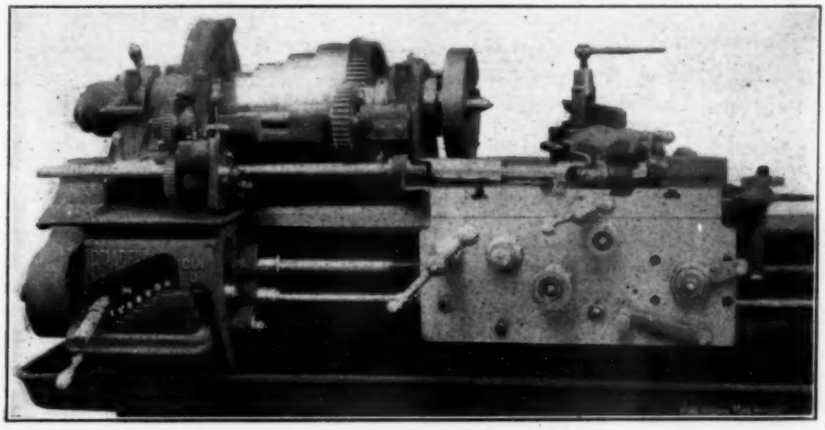
Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Relieving Attachment

The relieving attachment illustrated herewith is made by the Bradford Machine Tool Company, Cincinnati, O., and can be furnished with its standard line of heavy-pattern lathes. It can be used in conjunction with the Bradford taper attachment and relieves straight or tapered work of any number of flutes from 2 to 24 inclusive.

A substantial bracket is built as a unit with all parts self-contained. This bracket with its parts is mounted securely on the headstock in front, as shown, in a position easily accessible to the operator. The attachment is driven by a spur gear meshing with the face gear, by which construction the attachment is speeded down and up in the same degree, as can be seen on the index plate. By using the face gear as a driver, accurate work is obtained as with the face gear keyed on spindle, if one part stops, the relieving attachment also stops revolving and the screw is entirely independent of the relieving attachment.



BRADFORD RELIEVING ATTACHMENT

A single fixed cam only is required, and is mounted on a shaft of large diameter and close to the shaft bearing, providing rigidity. This cam actuates one arm of a lever through a roller on a tool-steel stud. The roller has a fixed position on the lever.

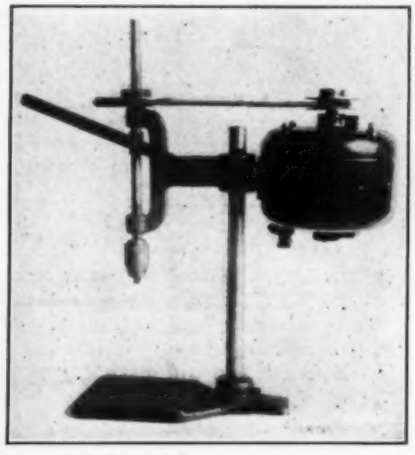
In this attachment the amount of relief is obtained in the following manner. The derived motion of the roller is transmitted through the rocking lever and connecting rod to the rocker shaft, and the rock shaft transmits the movement to the compound rest. One end of the connecting rod is attached to a sliding block capable of adjustment toward and away from the center of the rocking lever. This adjustment controls the amount of motion to be transmitted to the rock shaft, and is obtained by means of a screw and nurled knob so placed that it is within easy reach of the operator. The relief is thus adjusted without stopping the lathe.

A bracket on the carriage supports that end of the rock shaft, the movement of which is transmitted through a telescopic sleeve and shaft and knuckle joints to a set of spur gears in the compound rest. On the side of one of these spur gears is an eccentric hub which engages the bronze nut in the compound rest, through which in turn passes the top slide screw.

The gear which meshes into the face gear is adjustably fixed to a suitably graduated flange which is keyed and set-screwed to the shaft, thus providing an adjustment between the tool and the work in first setting up to 1/1000 of an inch without disconnecting. The carriage of the lathe has full traverse between centers and the movements of the compound rest are always available. The attachment need not be removed when doing ordinary work, as simply locking the small quadrant of the attachment up or down respectively disengages or engages the attachment. Gear guards are placed over all exposed gears.

Small Bench Driller

The motor-driven bench driller shown herewith has a capacity for drills up to ¼ inch. The spinde has a travel of 3 inches and the sliding head a movement of 7 inches on the column. The spindle speed is 1000 revolutions per minute.



SMALL BENCH DRILLER

The machine weighs 30 pounds, and the motor, 1/20 horsepower, is furnished for either direct or alternating current.

The driller is made by the Willey Machine Company, Jeffersonville, Indiana.

New Line of High Speed Taps and Dies

A complete line of high-speed taps and dies has recently been developed by the Simplex Tool and Supply Company, Boston, Mass. Allen's high-speed steel is used in the manufacture of the taps and dies.

On a recent test of a 1-inch Simplex high-speed pipe tap, 30,000 pipe fittings of gray iron were tapped without impairing to any great extent the tap used.

Spring Making Machines

The accompanying halftones show spring-cutting, coiling and winding machines recently developed by the Baird Machine Company, Oakville, Conn.

Fig. 1 shows a spring-coiling and cutting machine furnished with either die or roll tools. This type of machine automatically takes the wire from the coil, feeds a predetermined length, and coils either right- or left-hand open- or close-

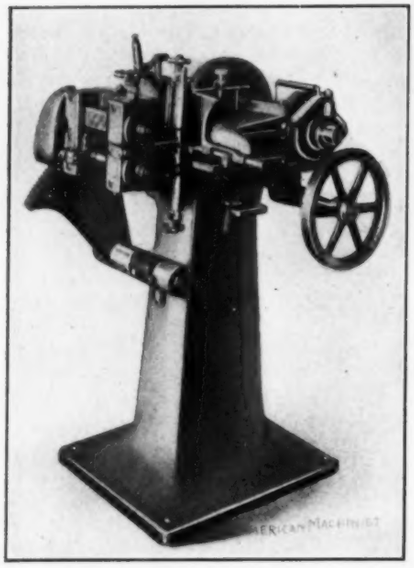


FIG. 1. SPRING-COILING AND CUTTING MACHINE

coil springs, and cuts them off. A diameter-changing attachment can also be applied which will make cone- or barrel-shaped springs. This machine is made in sizes taking wire up to about 3/16 inch diameter, and will make springs up to about 2 inches in diameter.

In Fig. 2 is shown a winding and cutting machine, which is considerably different in principle from the coiling type. This machine also makes open or close, right- or left-hand, and some types of cone

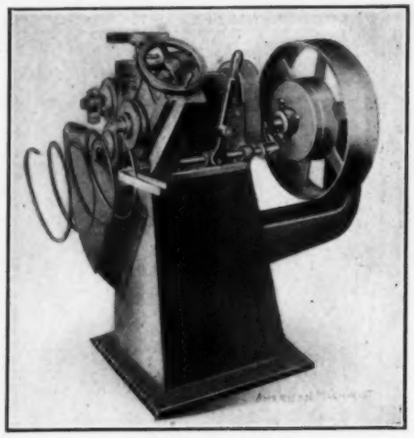


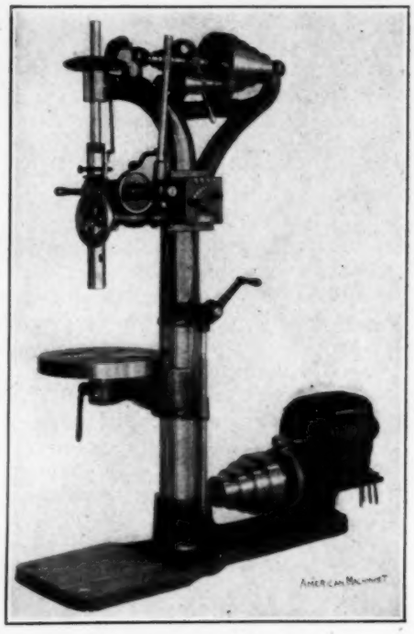
FIG. 3. CONTINUOUS SPRING-COILING MACHINE

springs, but all have straight ends. The lengths of the ends can be varied within limits.

The machine shown in Fig. 3 is a continuous-spring coiling machine, somewhat on the order of the other one shown, except that in this machine the springs are not cut off. This type is, therefore, used for making long springs, which consume so much wire that it is impracticable to feed it in lengths.

Motor Driven Driller

The 20-inch motor-driven driller shown herewith is of simple design and has a 9-inch drive pulley carrying a 2¾-inch belt, together with large cones, back gears of about 4 to 1 ratio, and 2 to 1 driving gears. The feed worm gear is driven by a steel worm running in an oil bath which insures constant and thorough lubrication to these vital parts. The steel lever is light enough for sensitive quick drilling and at the same time strong enough for heavy work. Changing from lever to wheel feed is effected by a slight twist of the lever, and both feeds are independent of one another. An adjustable automatic stop collar on the spindle sleeve trips a latch which releases the



MOTOR-DRIVEN DRILLER

worm-box lever and the entire mechanism swings away from the worm gear on a hinge pin. A means of taking up the wear on the worm or worm gear is provided by this worm-box lever. The vertical feed shaft is driven by a worm gear and worm running in oil, which derives its power from the top shaft through cone pulleys.

The machine is built by the Sibley Machine Tool Company, South Bend, Ind.

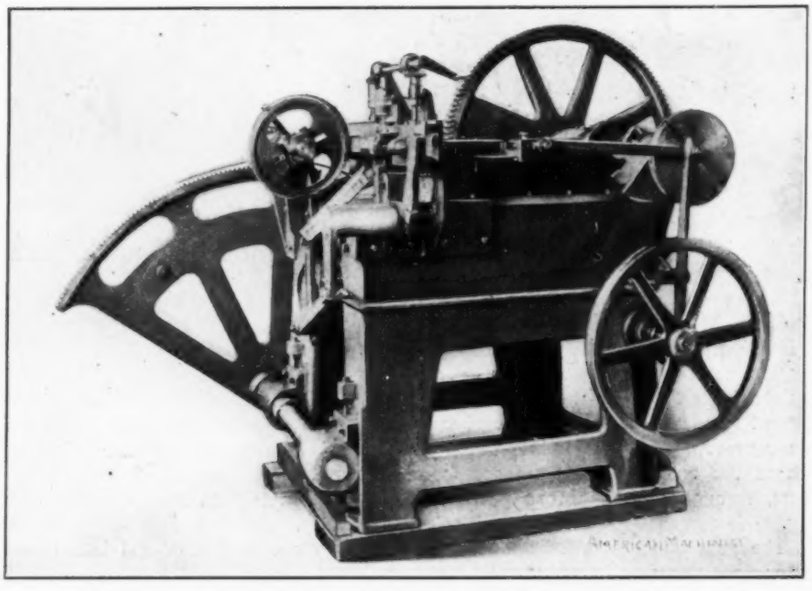


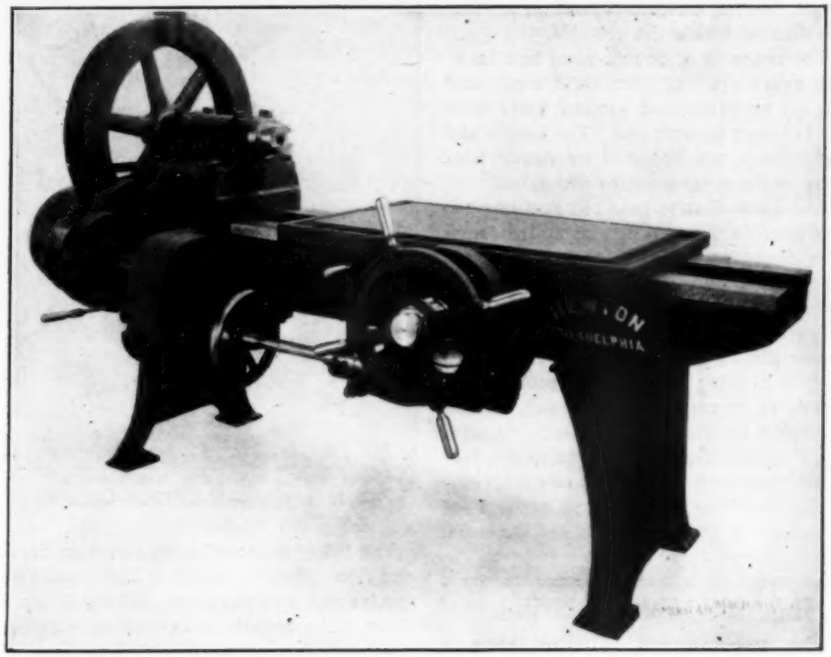
FIG. 2. A WINDING AND CUTTING MACHINE

Improved Single Spindle Boring Machine

The machine shown herewith was designed particularly to bore the cylinders of air compressors, small pumps, automobile cylinders and crank and transmission cases.

The spindle of this machine is 3½ inches in diameter, revolves in capped bearings 16 inches long overall; the spindle is fitted with a broad-faced key for driving and through retaining bolt for holding the sockets or bars in the No. 11 Brown & Sharpe taper. The work table is 21 inches wide by 36 inches long over the working surface, entirely surrounded by an oil pan, and the distance from the center of spindle to the top of table is 8¼ inches. The work table has square-locked bearings on the base, and

the side adjustment is made by means of a taper shoe; the feed is by means of a rack and spiral gear, is clutched positively and has three changes of gear feed, ranging from 0.010 inch, 0.015 inch to 0.050 inch per revolution of the spindle. There is an automatic release to the feed and the table can also be operated by hand. The small handwheel shown near the gear case is to permit the easy engagement of the clutches. The drive to the spindle is by means of a large spur gear and cone having three cutting speeds of 17.1, 22.8 and 30.4 revolutions per minute, and the steps of the cone are 15 inches, 17½ inches and 20 inches diameter each, 4 inches face; the length of feed to the table is 32 inches.



SINGLE-SPINDLE BORING MACHINE

The machine is manufactured by the Newton Machine Tool Works, Philadelphia, Penn.

Hobbing Attachment on Vertical Gear Cutter

The accompanying illustration shows a 24x8-inch spur- and bevel-gear cutter arranged with an automatic worm-wheel hobbing attachment and constant-speed motor drive, as designed and manufactured by Gould & Eberhardt, Newark, N. J.

The hob is mounted on the vertical cutting cutter slide and the cutter slide is adjusted so that the center of the cutter arbor is in line with the center of the worm blank to be cut, and securely locked in position. In order to insure that the cutter-slide feed or return clutch does not engage and move the hob out of position, a safety pin has been provided to hold the trip lever and clutch in proper position. The direct-reading cutter-slide feed gear-box dial can also be placed at zero, at which point the cutter-slide feed gears are disengaged, which doubly prevents the cutter slide from feeding.

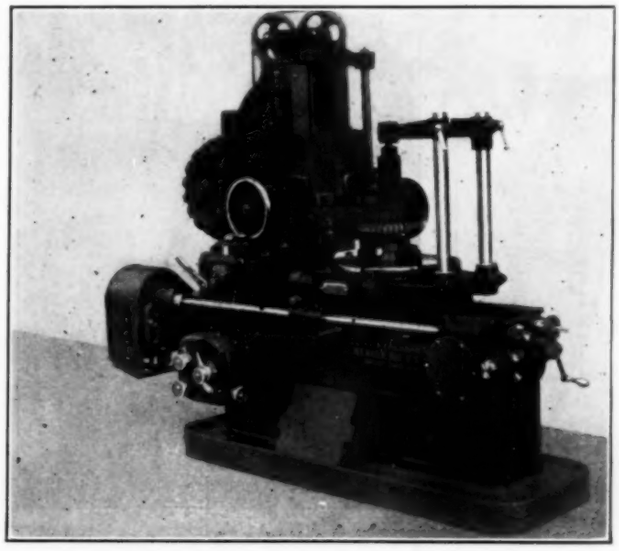
A chart is furnished to gear up the indexing mechanism the same as for spur gears, according to the number of teeth in the worm wheel, and means are provided for maintaining the proper relation between the hob and the work for the various cutter revolutions. The positive-indexing mechanism is so arranged as to allow the work to revolve continuously.

The feeding in of the blank is automatically taken care of by means of a feed lever and pawl, which gets its motion from the worm shaft through worm and worm wheel. The amount of feed per revolution of blank may be changed by means of cam and dial graduated in thousandths.

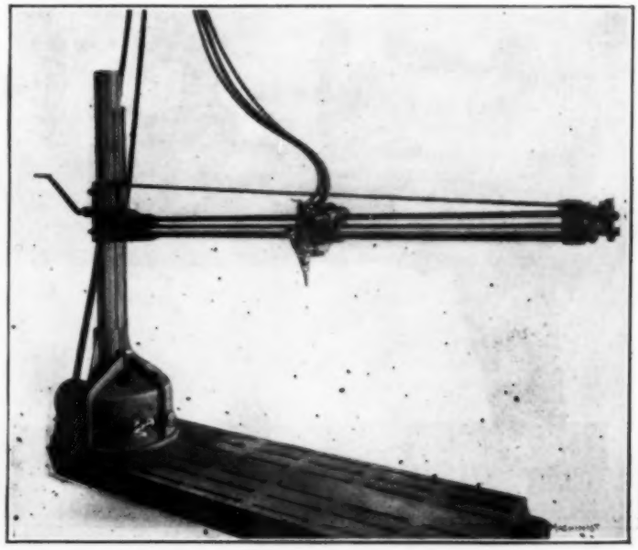
When the hobbing attachment is not needed, the worm on worm shaft that imparts motion to the feed mechanism may be easily disengaged, so that these parts do not rotate and become worn when the machine is being used on spur or bevel gears.

Acetylene Welding and Cutting Machine

The accompanying halftone shows an acetylene welding and cutting machine, recently built by the Davis-Bournonville Company, 90 West street, New York City. As will be noted, there is a cylindrical upright 6 or 7 feet in hight. This carries a long, hollow arm projecting for 6 or 7 feet on one side. By means of a rack and pinion, this arm may be adjust-



HOBBING ATTACHMENT FOR VERTICAL GEAR CUTTER



ACETYLENE WELDING AND CUTTING MACHINE

ed to any hight desired. The arm carries a long screw, rotatably and horizontally mounted in suitable bearings. At the base of the upright, loose and tight pulleys are mounted on a short horizontal shaft and are driven from an ordinary countershaft above. At one end of this short shaft, a friction pinion is arranged. This latter shaft and a rotatable rod arranged in the hollow arm are put into driving connection by bevel gears. At the outer end of the arm, an arrangement of gears enables the inclosed rod to drive the screw. The turning of this screw operates a carriage back and forth horizontally along the arm. Upon the carriage, the torch and its controlling fixtures are mounted. The work is placed or secured on a suitable fixed table. Flexible tubes bring the oxygen and acetylene to the torch. The tip is practically the ordinary form. It is arranged at an angle, say 40 or 45 degrees, to the horizontal, this angle being to the rear of the welding movement.

Heavy Quick Change 15 Inch Engine Lathe

The engine lathe shown in the accompanying halftone is heavily constructed, having reinforcements under the V's which extend below the top of the girths.

The headstock is webbed its entire length, and the center line of the head and tailstocks is placed back of the center line of the bed, eliminating overhang of the tool when turning large diameters. This construction admits a deep web between the headstock housings and a cone pulley of large diameter, thus giving high driving power. The spindle is high-carbon steel, accurately ground, and runs in self-oiling phosphor-bronze bearings.

The spindle of the tailstock is extra long and telescopes through a thimble at the rear. It has a full-length bearing in the barrel at forward limit of travel and is gripped by two sets of double-plug clamps at both ends of the barrel. This spindle and clamping device is operated by a single handle. The shape of tailstock permits setting the compound rest at an angle of 90 degrees when using tool on small diameters. Set-over screws and graduated index are provided for taper work.

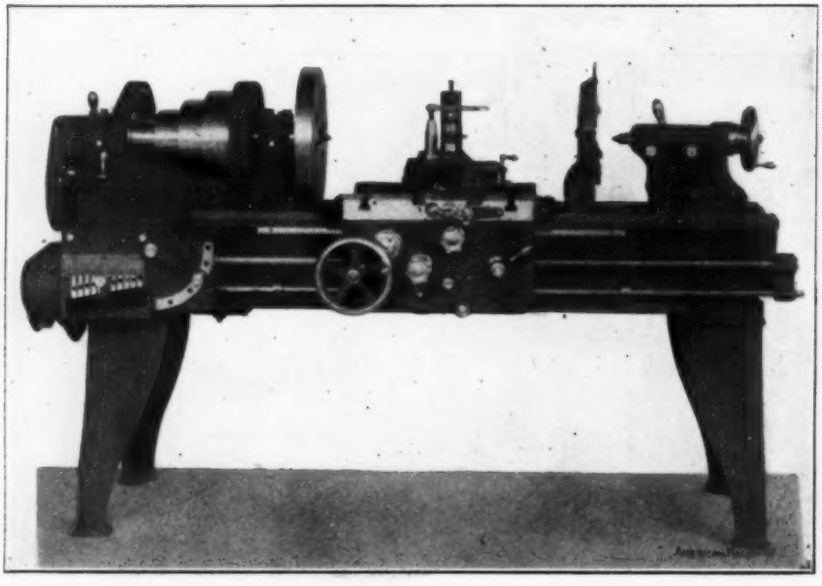
The carriage is extra heavy, with full-length bearing on each V and on a wide, flat bearing inside the front V.

The apron is of double-plate box form. The gears are cut from solid steel, and run on hardened and ground studs having bearings at each end. The length and cross feeds are operated by heavy frictions and are reversed in the apron.

The quick-change gear box requires but two handles for cutting the entire range of threads and feeds. Means are provided for cutting special threads, if desired, by substituting various change gears on the two studs at the head end.

For thread cutting, the lathe is fitted with a chasing dial, which permits the thread to be caught at any point without reversing the lead screw. Both countershaft pulleys are thus allowed to run forward, providing a wide range of speeds.

The machine is a recent product of Greaves, Klusman & Co., Cincinnati, Ohio.



HEAVY QUICK-CHANGE 15-INCH ENGINE LATHE

Ingersoll Cutter Grinder

The accompanying halftones show a 24-inch cutter grinder recently developed by the Ingersoll Milling Machine Company, Rockford, Illinois.

The machine is of rigid construction, and provision is made for wet grinding. The design, as will be noted, keeps the grinding fluid pretty well confined. Its range of work is cutters from ⅛-inch to 4-inch face, and from 4½ to 24 inches in diameter, in addition to which the face, side and corner, whether round or angular, of any size or angle cutter within the machine's capacity can be ground with one setting.

All controlling attachments are placed within easy reach of the operator's working position, and all adjustments are graduated to thousandths of an inch.

FIG. 1. INGERSOLL CUTTER GRINDER

The cutter is mounted on an arbor, carried in the spindle. The spindle revolves on ball bearings, making it sensitive. The spindle is carried by a quill, which is given vertical adjustment by a pinion, the worm wheel being carried in the saddle, which has horizontal adjustment.

The longitudinal adjustment of the saddle and the vertical adjustment of the quill are graduated to thousandths of an inch. This horizontal and vertical adjustment is all that is necessary to place

FIG. 2. CUTTER IN PLACE SHOWING SETTING FINGER FOR CLEARANCE

the cutter in the proper position for grinding. The emery wheel is mounted on the spindle, which revolves in bronze bushings with taper cone to take up lost motion. The spindle is carried in a sleeve, which has 5-inch adjustment with counterweighted lever. The sleeve carrying the spindle is carried in a saddle, which has hand adjustment of 1½ inches by means of a handwheel, graduated to thousandths of an inch. The saddle in turn is carried in a yoke, counterweighted and revolving on roller bearings, swings through an arc of 90 degrees from a horizontal to a vertical position. Its angular position at any point is indicated on a quadrant. The flow of the cutting fluid, regulated by a valve, is directed at the cutter through a nozzle and drained to the tank at the bottom, from which it is again pumped through the machine.

A center gage is furnished with the machine to facilitate setting fingers for grinding the clearance on right- and left-hand cutters as shown in Fig. 2. Four radius gages are also furnished, three for round corners of ⅛-inch, ¼-inch and ⅜-inch radius; the fourth is set for a square corner or 0.0-inch radius.

For grinding angular cutters, the yoke may be easily set at a desired angle on the quadrant, graduated in degrees from 0.0 degree to 90 degrees.

For grinding round corners, the spindle sleeve is locked by a stop on the yoke. The radius gage to which the cutter is set, designates the radius of the corner of the tooth. This corner is ground by swinging the counterbalanced yoke over each tooth.

The machine is arranged to be driven by belt from countershaft or motor, and weighs about 1300 pounds.

The Suggestion Box

Whenever the suggestion-box idea fails, it can usually be attributed to injudicious management in some particular. All suggestions should be considered on their merit, whether they are made by the latest apprentice or the general manager. And while there are bound to be many which are impossible or foolish in the extreme, the time taken to consider them all will be well repaid in the long run.

The idea that no suggestions are worth considering unless made by the foremen or planning department shows a short-sightedness that is inexcusable in anyone claiming managerial ability. A case that came to light recently shows this in all its glaring absurdity.

A boy on a driller, working for a dollar a day, made a suggestion that saved the firm $8000 the first year. Possibly the planning department should have thought of it, but it did not. Nor can it be expected to have all the brains of the establishment.

And even if the suggestion box does develop a prolific crop of criticisms of the management, it cannot profitably be abandoned on that account. It is barely possible that some of the criticisms may be justified and are worth considering carefully.

The objection that men waste time in going to other departments and criticizing them, is really pointing to a weakness in a time schedule or management which makes such a thing possible. If a time study is worth the paper it is written on, there is very little time for visiting around the shop. Suggestion boxes or any other methods which draw out ideas and secure coöperation, are well worth all they cost.

Table of Tests of Lubricating Greases

Through an inadvertence an important table accompanying the article of G. W. Lewis, printed on page 356, was omitted. This table is now given herewith over the caption "Summary of Grease Tests made on a Cornell Oil Testing Machine."

		Base of Grease	Duration of Test	Pressure on Bearing, Pounds per Square Inch	Velocity of Rubbing, in Feet per Minute	Maximum Temperature of Bearing, Degrees Fahrenheit	Temperature of Bearing Above Room Temperature	Coefficient of Friction
Group I	1	Mineral	60 minutes	143	450	159	80	0.00595
	2	Mineral	60 minutes	214	450	173	94	0.00547
	3	Mineral	60 minutes	286	450	178	97	0.00383
	4	Mineral	60 minutes	357	450	186	103	0.00326
	5	Mineral	60 minutes	214	450	138	64.2	0.0032
	6	Mineral	60 minutes	143	450	122	50	0.0036
	7	Animal	60 minutes	86.2	215	96	26	0.0070
	8	Animal	60 minutes	172.4	224	115	45	0.010
	9	Animal	60 minutes	258.6	228	119	49	0.010
	10	Animal	60 minutes	344.8	229	137	67	0.0105
	11	Animal	60 minutes	431	218	139	69	0.0104
	12	Animal	60 minutes	86.2	217	96	25	0.0050
	13	Animal	60 minutes	172.4	228	112	42	0.0082
	14	Animal	60 minutes	258.6	231	128	58	0.0100
	15	Animal	60 minutes	344.8	217	132	62	0.0096
	16	Animal	60 minutes	431	226	146	76	0.0097
	17	Animal	60 minutes	86.2	216	91	22	0.0045
	18	Animal	60 minutes	172.4	225	111	41	0.0080
	19	Animal	60 minutes	258.6	228	119	49	0.0097
	20	Animal	60 minutes	344.8	214	135	70	0.0125
	21	Animal	60 minutes	431	225	142	75	0.0117
	22	Mineral	60 minutes	86.2	216	98	25	0.0058
	23	Mineral	60 minutes	172.4	223	104	29	0.0071
	24	Mineral	60 imnutes	258.6	228	123	47	0.0080
	25	Mineral	60 minutes	344.8	223	136	61	0.0090
	26	Mineral	60 minutes	431	231	146	72	0.0072
	27	Mineral	60 minutes	86.2	214	92	24	0.0080
	28	Mineral	60 minutes	172.4	222	110	40	0.0100
	29	Mineral	60 minutes	258.6	225	120	58	0.0100
	30	Mineral	60 minutes	344.8	232	137	63	0.0100
	31	Mineral	60 minutes	431	233	173	99	0.0120
	32	Mineral	60 minutes	86.2	213	94	28	0.0080
	33	Mineral	60 minutes	172.4	224	122	55	0.0115
	34	Mineral	60 minutes	258.6	231	140	62	0.0113
	35	Mineral	60 minutes	344.8	231	144	74	0.0116
	36	Mineral	60 minutes	431	234	156	87	0.0116
	37	Mineral	60 minutes	86.2	215	90	16	0.0090
	38	Mineral	60 minutes	172.4	224	105	31	0.0095
	39	Mineral	60 minutes	258.6	228	117	44	0.0106
	40	Mineral	60 minutes	344.8	228	133	60	0.0115
	41	Mineral	60 minutes	431	228	143	71	0.0120
	42	Mineral	60 minutes	86.2	218	90	21	0.0094
	43	Mineral	60 minutes	172.4	217	101	31	0.0084
	44	Mineral	60 minutes	258.6	222	128	58	0.00925
	45	Mineral	60 minutes	344.8	223	154	83	0.00925
	46	Mineral	60 minutes	431	214	157	89	0.0115
	47	Mineral	60 minutes	86.2	231	98	28	0.0062
	48	Mineral	60 minutes	172.4	234	116	46	0.0095
	49	Mineral	60 minutes	258.6	233	139	58	0.0093
	50	Mineral	60 minutes	344.8	233	151	86	0.0098
	51	Mineral	60 minutes	431	214	162	95	0.0150
Group II	52	Mineral	60 minutes	86.2	219	98	34	0.0238
	53	Mineral	60 minutes	172.4	234	127	63	0.0215
	54	Mineral	60 minutes	258.6	236	142	79	0.0201
	55	Mineral	60 minutes	344.8	241	154	91	0.01905
	56	Mineral	60 minutes	431	241	170	106	0.0182
	57	Mineral	60 minutes	517.2	243	174	111	0.0176
	58	Animal	60 minutes	86.2	222	98	34	0.0220
	59	Animal	60 minutes	172.4	227	122	56	0.0223
	60	Animal	60 minutes	258.6	231.5	149	81	0.0222
	61	Animal	60 minutes	344.8	232.5	185.5	116	0.0243
	62	Animal	60 minutes	431	231.5	235	165	0.0343
	63	Mineral	60 minutes	86.2	216	100.5	37	0.0236
	64	Mineral	60 minutes	172.4	221	146	81	0.0204
	65	Mineral	60 minutes	258.6	225	165	100	0.0203
	66	Mineral	60 minutes	344.8	234	240	173	0.0255
	67	Mineral	60 minutes	431	223	265	198	0.0512
	68	Mineral	60 minutes	86.2	212.5	120	55	0.041
	69	Mineral	60 minutes	172.4	223	200	134	0.050
	70	Mineral	60 minutes	86.2	232	116	44	0.0224
	71	Mineral	60 minutes	172.4	234	125.5	53	0.0180
	72	Mineral	60 minutes	258.6	.....	143	71	0.0178
	73	Mineral	60 minutes	344.8	.....	161	88	0.0183
	74	Mineral	60 minutes	431	.....	.....	.....	0.028
		Lard Oil Bearing Run in a Bath of Lard Oil	60 minutes	86.2	220	85	18	0.0100
				172.4	229	96	29	0.0105
				258.6	222	100	33	0.0107
				344.8	220	114	46	0.0115
				431	229	135	67	0.0130

SUMMARY OF GREASE TESTS MADE ON A CORNELL OIL TESTING MACHINE

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

Frank Gousett will build a garage on West Center street, Lee, Mass.

The Wright Wire Company, Palmer, Mass., will build a two-story addition to its plant.

The Worcester (Mass.) Pressed Steel Company will build a steel foundry in addition to its plant.

The screwdriver and spring factory of the Tuck Manufacturing Company, Brockton, Mass., was damaged by fire to the extent of $25,000.

Work has been started on two new buildings to be erected at the Stanley branch of the General Electric Company, Pittsfield, Mass., to cost $500,000.

The Royal Brass Manufacturing Company, Bridgeport, Conn., has recently filed certificate of incorporation. Brass goods are to be manufactured.

Palmer & Upson, Westfield, Mass., are in the market for a stamping machine with press attachment for stamping and printing caps for milk bottles.

The Millers Falls Company, Millers Falls, Mass., manufacturers of hardware, is building several additions to its plant. New machinery will be installed to double the capacity of its plant.

The Superior Spiral Tool Driver Company, Springfield, Mass., has been incorporated. The officers are David Rioux, president; Arthur J. Brunnelle, treasurer; both of Springfield, Mass.

F. E. Wells & Son Company, Greenfield, Mass., manufacturer of machine tools, has purchased a site in Turners Falls, Mass., where a drop-forging plant will be erected, same to be operated by electricity.

American Chocolate Machine Company, Kittery, Me., has been incorporated for the manufacture of confectionery machinery. Horace Mitchell and C. E. Snothers are president and treasurer respectively, both of Kittery.

The Automatic Needle Threader Company has been organized in Augusta, Me., for the manufacture of sewing-machine attachments and special machinery. The officers are E. J. Pike, president, and F. J. Coleman, treasurer, both of Augusta.

The Hopkins & Allen Arms Company, Norwich, Conn., manufacturer of fire arms, has been sold to a syndicate organized by the W. T. Fields Company, of New Haven, Conn. The new company is capitalized at $500,000 and contemplates enlarging the plant.

Automatic Coin Vending Company, of Bridgeport, Conn., has been incorporated to manufacture vending machines. Capital, $50,000. Incorporators, Daniel P. Higgins, New Haven; Gabriel H. Hyman, 4 Manhattan avenue, N. Y.; Edward A. Godfrey, Bridgeport.

MIDDLE STATES

H. G. Slatmyer, Cleveland, O., will erect a garage.

G. F. Reilly is having a two-story garage erected at Bala, Penn.

The Benz Auto Company will erect a new plant at Detroit, Mich.

R. J. Scott has let contract for a garage to be erected at Wynnewood, Penn.

George Bauer will build a garage at 2946 North Illinois street, Indianapolis, Ind.

The Foundries Company (iron foundry), Carville, O., has doubled capital to make improvements.

The Hamilton (O.) Autographic Register Company will build an addition to its plant in Lindenwald.

The plant of the Conklin Pen Manufacturing Company, of Toledo, O., was partially destroyed by fire.

E. L. Leeds has let contract for a garage at Sixty-third street and Wissahickon avenue, Philadelphia, Penn.

The Sidney Tool Company, Sidney, O., recently doubled its capital stock and will make improvements.

A plant is in course of construction in Hackettstown, N. Y., to be occupied by the American Saw Works.

The Chicago (Ill.) Screw Company will build a three-story brick addition to its plant at 3430 Fillmore street.

The Continental Can Company is erecting an addition to its plant at East Washington street, Syracuse, N. Y.

The Reading (Penn.) Iron Company is to erect new building for No. 5 mill of the tube works on Willow street.

W. P. Kingsley, of Detroit, Mich., is having a foundry erected there and will do a general foundry business.

M. Boyle is having a large addition built to his garage at Twentieth and Brandywine streets, Philadelphia, Penn.

M. Rabbitt & Sons, contractors for docks and dredges, etc., are erecting an addition to their plant at Toledo, O.

The Globe Machine and Stamping Company, Cleveland, Ohio, has prepared plans for the erection of a machine shop.

The Syracuse (N. Y.) Ornamental Company, making casket handles and ornaments, will erect a five-story factory.

The garage of W. T. Hughes, of Fortieth and Chestnut streets, Philadelphia, Penn., was destroyed by fire. Loss, $5000.

Pfingstag Brothers have let contract for an addition to their garage at 846 East Chelton avenue, Philadelphia, Penn.

The American Motor Truck Delivery Company, Toledo, Ohio, organized by D. Smith and others, will build a garage.

The Air Friction Carbureter Company, Dayton, O., has added to capital and will increase manufacturing equipment.

The University of Detroit at Detroit, Mich., is to establish a course in mechanical engineering and will need equipment.

The Perfection Spring Company, Cleveland, Ohio, will build a new factory. The building will be one story, 60x140 feet.

The Chain Belt Company, of Milwaukee, Wis., will erect a $25,000 machine shop at Muskegon avenue and Park place.

The Rummel Machine Screw Company, Cleveland, O., is to add case-hardening and grinding departments to its plant.

At Akron, O., foundations have been started for a $50,000 brick and steel foundry plant for the Atlantic Foundry Company.

The Iron Tube and Supply Company, Cleveland, Ohio, will increase its capital to expand its business and increase facilities.

J. H. Laverell has let contract for a garage to be erected at 4536 to 4538 Baltimore avenue, Philadelphia, to cost $5000.

Permit has been granted the Armour Steel Foundry Company for an addition to its plant at Winton place, Cincinnati, O.

The American Multigraph Manufacturing Company, Cleveland, O., has increased capital and will make improvements to plant.

The Grand Crossing Tack Company, 7755-57 South Chicago avenue, Chicago, Ill., will build a one-story addition to its plant.

The Toledo (O.) Machine and Tool Company is making plans for the enlargement of plant to take care of increased business.

Contracts for the construction of the new Metzger Motor Company's plant at Highland Park, Detroit, Mich., have been awarded.

The American Rotary Valve Company, Chicago, Ill., is in the market for additional machinery for its new plant at Anderson, Ind.

Charlton & Kirk have let contract for a garage to be erected at Forty-sixth and Chestnut streets, Philadelphia, Penn., to cost $10,000.

A machinery requisition, including several heavy metal-working tools, has been issued by the Big Four System for its Indianapolis, shop.

J. T. Ryerson & Son, 2528 to 2550 West Eighteenth street, Chicago, Ill., will build a one-story brick addition to be used as pattern shop.

The Safety Cylinder Valve Company, Mansfield, O., has increased its capital stock from $100,000 to $125,000 and will make improvements.

The Motor Foundry Company, Detroit, Mich., a new concern, will erect a large foundry for the casting of gray-iron automobile parts.

The Commercial Truck Company has let contract for an addition to its machine shop at Twenty-seventh and Brown streets, Philadelphia, Penn.

The Johnson Bearing Company, Detroit, Mich., has been incorporated to manufacture and deal in bearings and parts of engines, automobiles, etc.

The plant of the Elaborated Roofing Company, Cleveland, O., was entirely destroyed by fire. Loss on contents of the building, $12,000.

The Nordyke & Marmon Company, Indianapolis, Ind., manufacturing mill machinery and automobiles, is in the market for additional machinery.

The American Stove Company, of Cleveland, O., has recently purchased a large tract of land near its factory on which it will erect additions.

The Lorain (O.) Metal Products Company has been incorporated for $60,000 to manufacture metal products of all kinds. F. J. Stock will be president.

The Weaver-Sealand Motor Company, Cleveland, O., has been incorporated, for the purpose of dealing in automobiles and carrying on a garage business.

The Isthmian Canal Commission, Washington, D. C., is to open bids on September 1, under circular 644, for a large quantity of mechanical-bond steel bars.

The Quaker City Iron Works purchased a plot of ground at Tiago and Edgemont streets, Philadelphia, Penn., where it will erect an addition to its plant.

Wire Goods Company, Akron, O., has been incorporated to manufacture all kinds of wire goods by L. J. Peter, H. G. Haynes, Roy F. Hamlin, etc. Capital, $10,000.

Adriance Platt & Co., manufacturers of mowers, have begun work on an additional factory building to cost between $75,000 and $80,000, at Poughkeepsie, N. Y.

H. B. Pancoast Company, manufacturer of heaters, etc., has let contract for a three-story addition to be erected at Front and Ellen streets, Philadelphia, Penn.

Camillus Cutlery Company, Camillus, N. Y., is planning to open a new plant for the manufacture of razors in the near future, to give employment to 100 additional men.

A. N. Russell & Sons Company, manufacturer of stove fixtures, at Ilion, N. Y., will erect a four-story addition to its factory, that will increase its output 25 per cent.

Georgian Manufacturing Company, Binghamton, N. Y., making brass goods, is putting up a 64x175-foot shop extension that will increase its capacity 50 per cent.

The Central Iron and Metal Company, Chicago, Ill., has purchased a site for a new plant at Rockwell street and Thirty-sixth place, and will build a $50,000 factory.

Incorporation papers have been granted the Fashion Garage and Automobile Company, Indianapolis, Ind. Incorporators, B. D. Gilson, W. L. Higgins and J. F. Edwards.

The Palmer-Moore Company, Syracuse, N. Y., manufacturer of the Moore two-cycle engine, is to install new equipment and materially increase its manufacturing facilities.

The Harrisburg Brass and Bronze Foundry, Harrisburg, Penn., has closed negotiations for the erection of a new one-story building, 30x72 feet. Calvin Weaver is president.

The Pratt Chuck Company, of Frankfort, N. Y., has broken ground for two new buildings, one for the manufacture of flexible conduit and the other for an acid-pickling room.

Casmire Company, Indianapolis, Ind., has been organized to manufacture freezing machines. Capital, $10,000. Incorporators, B. A. Casmire, Charles A. Barrett, C. B. McCulloch.

The Superior Building Company, of Cleveland, has been awarded a contract for the erection of a brass foundry for William Scherer on West Eighty-fifth street, Cleveland, O.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids Sept. 12, for one 500-ton power press for the Washington navy yard as per Schedule No. 3853.

Snyder Aëroplane Company, Osborn, O., has been organized with $5000, preliminary capital, to manufacture aëroplanes and airships, by Charles B. Snyder, Al Strimmell, J. F. Esterline, etc.

A company for the manufacture of automobiles, machinery and supplies has been formed and incorporated under the name of the Hudson Valley Automobile Company, Yonkers, N. Y.

Midland Electric and Manufacturing Company, Chicago, Ill., has been incorporated to manufacture mechanical devices. Incorporators, Andrew Engstrom, Arthur O. Carlson, Fredrick Deiser.

Hoblit Nut-Lock Company, Dayton, O., has been organized to manufacture nut locks of all kinds. Incorporators, Boston F. Hoblit, Alfred J. Carter, Gilbert F. Brown, etc. Capital, $10,000.

Lorain Metal Products Company, Lorain, O., has been incorporated with a capital of $30,000 to manufacture and sell metal products of all kinds by F. J. Stock, L. C. Lorenz, E. J. Maple, etc.

The Fisher Koons Electric Company, Warren, O., has been incorporated to do a general electrical construction business. May require some machine tools. Incorporators, I. W. Fisher, etc.

The Premier Manufacturing Company, of Newark, N. J., has been incorporated for the purpose of manufacturing metallic packing. Incorporators, I. Shoenthal, L. J. Walsh and J. J. Bolan.

Globe Wire and Fence Company, Cleveland, O., has been incorporated with $20,000 capital to manufacture and sell wire and fence by Clewell M. Smith, William C. Smith, A. E. Williams, etc.

The Motor Foundry Company, Detroit, Mich., a new concern, is erecting a foundry on Hart avenue and the Detroit terminal to cost about $18,000. The concern will specialize in automobile parts.

The C. M. Grey Manufacturing Company, East Orange, N. J., has been organized with $50,000 capital to operate machine shop, foundry, etc. Incorporators, Charles M. Grey, E. L. Grey, C. H. Duckworth.

The Eclipse Clutch Manufacturing Company, Evansville, Ind., has been incorporated with a capital of $100,000 by J. G. Beckmann, E. C. Altenbernd, J. W. Ford and others to manufacture automobile clutches.

Climax Nutlock and Bolt Manufacturing Company, Cleveland, O., has been incorporated with $15,000 capital to manufacture bolts, locks, etc., by C. L. Dunham, V. C. Walker, S. Dunham, E. Witkowsky, etc.

The J. H. Day Company, manufacturer of bakers' and paint-making machinery, will build a two-story addition to plant at Cincinnati, O., for which considerable machinery and equipment will be required.

The Simplex Auto Cranker Company, Chicago, Ill., has been incorporated to manufacture and deal in automobiles and machinery. Capital, $100,000. Incorporators, E. A. Gardner, I. F. Halton, Wilfred Patrick.

The Imperial Machinery Company, Cincinnati, O., has been organized with $50,000 capital to manufacture and sell all kinds of laundry and dry-cleaning machinery by John W. Daley, Thomas H. Kelly, H. Williams, etc.

The Sebring Manufacturing Company, Paulding, Paulding county, O., has been organized with $3000 preliminary capital, to manufacture all kinds of agricultural machinery, by C. H. Allen, C. F. Miller, George Burgner, etc.

Work is progressing rapidly on the four new buildings of the Gould Manufacturing Company, Seneca Falls, N. Y., which is planned to be completed by January 1, 1912, and will be used in the manufacture of hand pumps.

The Courtland Motor Wagon Company, Courtland, N. Y., manufacturing light delivery motor wagons, will move its plant to Pittsfield, Mass., where it will occupy the building recently vacated by the Tel-Electric Company.

The Precision Steel Ball Company, Syracuse, N. Y., has been incorporated with an authorized capital of $100,000 to manufacture ball bearings and kindred articles. Directors are Alex T. Brown and Wm. C. Lipe, of the Brown-Lipe Gear Company, and others.

The Cahen Manufacturing Company, Cleveland, O., has been incorporated with a capital of $20,000, to manufacture and sell machines and machinery of all kinds, especially that used in bookbinding. Incorporators, S. I. Kerrnish, L. A. Moscha, Alfred Cahen, etc.

Within a month the Hartford Suspension Specialty Company will have established its manufacturing plant in Jersey City, N. J., where its new modern factory building is in course of construction. The company manufactures an automobile shock absorber.

The American Car and Foundry Company has purchased land at Gary, Ind., and it is said the company will begin the erection of a plant this fall that will cost $10,000,000 and employ 6000 men. The company will build street cars exclusively at the Gary plant.

The announcement is made by General Manager C. G. Heyne, of the American Cash Register Company, of Columbus, Ohio, that the plant might be removed to Detroit, Mich. Mr. Heyne says the company intends to erect a new plant which may be located in the Michigan city.

The Hollow Metal Construction Company, Jersey City, N. J., has been incorporated with $150,000 capital to manufacture metal building materials. Offices are at 45 Webster avenue. Incorporators, M. C. Duane, N. E. Wiggins, George W. Everett, 257 Broadway, New York.

The L. C. Smith & Brothers Typewriter Company, Syracuse, N. Y., which made a start on the foundation for an addition to its factory, some three years ago, is now bringing the addition toward completion. It will be eight stories high, and about double its present capacity.

Incorporation papers have been filed for the Champion Engine Company, Roseville, N. J. Incorporators, A. L. Goldspink, Roseville; P. H. Wiederman, Kingsland, and J. Hoyer, Burnside, N. Y. The company is to manufacture ice-breaking machinery, and ice-cream machines.

Macdonald & Sons Manufacturing Company was recently incorporated at Buffalo, N. Y., with a capital of $100,000. This concern will locate in a factory building at 60 Cherry street, Buffalo, and will manufacture machinists' tools, as well as handle jobbing business in the same line.

The announcement is made that the Ohio Steel and Wire Company, recently incorporated, with offices in the Columbus Savings and Trust building, Columbus, O., will soon start the erection of a new plant at Warren, O. E. A. Henry is president and general manager of the concern.

A site for what is reported will be a $400,000 wire mill has been selected in Warren, O., and a company to be known as the Ohio Steel and Wire Company has been formed, and will start the building of the plant at once. The mill is to manufacture mattress wire, copper wire and other products.

A large locomotive and car-repair shop will be erected at Cincinnati, Ohio, by the Baltimore & Ohio Southwestern Railway Company. The new shops will employ about 2000 men and this improvement contemplates the ultimate abandonment of the present shops at Chillicothe, Ohio, and Washington, Ind.

The Globe Automatic Sprinkler Company has been organized with $75,000 capital by W. R. Koehler, R. A. Koehler, A. B. Koehler, A. B. Gould, et al., and will build a factory at Minneapolis, Minn. The offices of the com-

pany are located at present in the First National Bank building, Cincinnati, Ohio.

Certificate of incorporation of the Pullman-Field Machine Company has been filed at Lyons, N. Y. The company is to manufacture all kinds of vehicles, engines and propelling machinery and the principal office is to be in Sodus, N. Y. The incorporators are, William Pullman, Charles H. Field and S. H. Fish.

The Cox Manufacturing Company, of Albany, N. Y., has increased its capital from $25,000 to $200,000, and will enlarge its Albany plant, take over a plant located in the Middle West and establish a new branch at Detroit, Mich. This concern manufactures all kinds of brass goods, a wind shield for automobiles, etc.

The Lake Shore & Michigan Southern Railway will build and equip a big car shop and repair plant on the site recently acquired at Air Line Junction, near Toledo, O. The estimated cost of this shop is in the neighborhood of $2,500,000 and, when completed, it will be the main plant for the construction and repair of rolling stock and motive power for the entire New York Central lines.

SOUTHERN STATES

The International Harrow Company, Birmingham, Ala., has organized with $500,000 capital to manufacture patented steel harrows. A drop-forge plant has been purchased and $10,000 will be expended for new machinery.

WEST OF THE MISSISSIPPI

The Pesch Foundry will be removed from Cherokee, Ia., to Algona, Ia.

J. Wood, East Caruthers street, Portland, Ore., will build a new machine shop.

Henry Siegert, Seattle, Wash., is planning for the erection of a new blacksmith shop.

Dawson Brothers' blacksmith shop at Albia, Ia., was destroyed by fire. Fully insured.

The Iowa Auto and Supply Company will have $20,000 garage built at Des Moines, Ia.

The plant of the Standard Welding Works, Los Angeles, Cal., was destroyed by an explosion.

The Standard Oil Company will build a new blacksmith shop on its fields at Fullerton, Cal.

The Portland (Ore.) Railway, Light and Power Company will build new car shops on East Crouch street.

The Imperial Clock Company will erect a two-story factory at 3419 to 3421 Rutger street, St. Louis, Mo.

The Los Angeles (Cal.) Motor Car Company is making alterations and improvements in its commercial garage.

A hardware factory is to be built at Leavenworth, Kan., by the Western Hinge and Manufacturing Company.

A. E. McDonald, Azusa, Cal., will build a commercial garage and repair shop. Modern equipment will be installed.

The Oklahoma City Hardware Company, Oklahoma City, Oklahoma, is erecting new quarters to cost about $60,000.

The Security Vault and Metal Company, Portland, Ore., has acquired a site and will build a new metal-working plant.

The Seattle, Renton & Southern Railway (electric) will build an addition to its carbarns on Rainier avenue, Seattle, Wash.

The McKinley Traction Cultivator Company is to build a new plant in St. Louis, Mo., for the manufacture of motor plows.

The California Fruit Canners Association, Los Angeles, Cal., has taken out a permit to erect a garage and repair plant for its cars.

The Duluth, Winnipeg & Pacific Railroad has awarded contract for erection of machine shop, roundhouse, etc., at Virginia, Minn.

The Sunset Fuel and Feed Company, Los Angeles, Cal., is having plans prepared for a new garage and machine shop on Eighth street.

J. A. Donato and A. Viole, Los Angeles, Cal., have taken out a permit to erect a commercial garage and repair plant on Pico street.

John Widner, Calexico, Cal., contemplates the erection of a commercial garage and repair plant. Modern machinery will be installed.

The Matthew-Davis Tool Company, St. Louis, Mo., is to construct a new factory building in that city calculated to cost about $25,000.

E. Henry Wemme, Portland, Ore., is having plans prepared for a large commercial garage and repair plant. Estimated cost, $60,000.

The car building and repair shops at the Cudahy Packing Company's plant at South Omaha, Neb., was destroyed by fire. Loss, $100,000.

The Burr Creamery Company, Los Angeles, Cal., has leased property adjoining its plant and will establish a garage and repair shop for its automobiles.

The Automobile Exchange and Repair Company has been incorporated at Seattle, Wash., by J. H. Hasbrook. An establishment will be maintained at Seattle.

The Oregon-Washington Railroad and Navigation Company, Seattle, Wash., will build a new machine shop on Delaware avenue. Estimated cost, $30,000.

The Kellar-Thomason Manufacturing Company, Los Angeles, Cal., manufacturer of irrigation machinery, plans for the establishment of an iron foundry plant.

A. Murphy & Sons will erect $15,000 auto garage and repair shop at Omaha, Neb., at Fourteenth and Jackson streets. J. E. Dietrick, architect, Paxton building.

Frederick Shoup, Los Altos, Santa Clara county, Cal., has had plans prepared for a commercial garage and machine shop. Modern machinery will be installed.

Don Lee, Los Angeles, Cal., is having plans prepared for a large commercial garage and repair plant on West Seventh street. The plant will be fully equipped.

The Davis Blacksmith Company, Miami, Ariz., will build an addition to its blacksmith shop to be used as a carriage repair works. Modern equipment will be installed.

The Omaha Railroad has awarded contracts for the construction of a roundhouse and other buildings in East Omaha, Neb. The machine house is to be 60x140 feet.

G. W. Jory, Marysville, Cal., is at the head of a company which plans for the establishment of a plant for the manufacture of a patented ditch digging machine.

The Mankato (Minn.) Motor Truck Company and the Red Wing Motor Company may consolidate and erect plant at Red Wing, Minn., for manufacture of motor trucks.

The Blake Specialty Company, Davenport, Ia., manufacturer of plumbing specialties, is planning to increase the size of its plant by the addition of a $10,000 building.

The National Patent Rivet, Tool and Development Company, Los Angeles, Cal., has been incorporated by R. W. Linville and F. I. Kinkenstein, with a capital of $25,000.

The Morton Gas Engine Company, Fresno, Cal., has decided to build an Eastern plant and R. A. Morton, president, has recently been in Norwalk, O., negotiating for a site.

The Arthur Bunker Motor Car Company, Seattle, Wash., will erect a new commercial garage and repair station. The plant will be two-story, and will be fully equipped with machinery.

The American Gas Engine Company, Ventura, Cal., recently incorporated, has acquired property on Laurel street and plans for the erection of a plant for the manufacture of gas engines.

The Board of Education, Santa Barbara, Cal., has had plans prepared for a manual training addition to the high school. Modern machinery will be installed, including lathes and band saws.

Watt Moreland, Los Angeles, Cal., is at the head of a company which plans for the establishment of a plant for the manufacture of commercial automobile trucks, using distillate as fuel.

The Holland-Domschke Foundry Company has been incorporated at Phoenix, Ariz., with a capital of $100,000 by Timothy Holland and R. P. Domschke. Offices will be established at Phoenix.

Extensive improvements and additions are being carried out by the Wood-Knight Hawk Manufacturing Company, Oklahoma City, manufacturers of the Pioneer automobile and a motor plow.

The Duluth, Winnipeg and Pacific Railroad, a subsidiary to the Canadian Northern, has let contract for the construction of a 10-stall roundhouse, machine shop and store room at Virginia, Minn.

The Berlin Machine Works, of Beloit, Wis., has selected site at Portland, Ore., for branch plant and plans for machine shop and foundry are being prepared. The concern manufactures wood-working machinery.

A manual training department will be installed in the new school to be erected by the Board of Education, Hermosa Beach, Cal. L. B. Pemberton, architect, Los Angeles. Modern equipment will be installed.

Manual training quarters will be provided for in the new school building to be erected by the city of Wasco, Cal. Modern equipment will be installed in the department. Wiseman & Biggar, architects, Bakersfield, Cal.

Ground has been broken for the new four-story commercial garage and automobile machine plant to be erected by the Western Motor Car Company, Los Angeles, Cal. The plant will be fully equipped. Earl C. Anthony is head of this company.

CANADA

The Montreal Steel Works is building a large new plant at Long Point, Que.

The Montreal Locomotive Works will erect an addition to cost $34,000 at Long Point.

The Waterous Engine Works will erect a $60,000 addition to its Brantford plant.

The Tallman Brass Company will build an addition to its plant at Hamilton, Ont.

The National Cash Register Company, of Dayton, O., will build a branch factory in Toronto.

L. B. de Laitte, of Vancouver, will equip a plant there for manufacturing gas-making apparatus.

The Positive Clutch and Pulley Works, of Toronto, will erect a $10,000 factory in Aurora, Ont.

The Schacht Motor Car Company, of Cincinnati, O., will build a big branch plant at Hamilton, Ont.

The department of railways and canals of Canada will equip a large new engine house and machine shop at Stellarton, N. S.

The plant of the Canadian Locomotive Works, Kingston, Ont., has passed into the hands of English capitalists and will be doubled in capacity.

Announcement has been made by the Doty Engine Company, Winnipeg, Man., of plans for a shipbuilding plant to be constructed at an estimated cost of $150,000.

General Manufacturing

NEW ENGLAND

W. G. Fiske, Upton, Mass., will install an electric motor in his lumber mill.

The West End Thread Company, Millbury, Mass., will build an addition to its plant.

Mansfield, Mass., will issue $22,500 bonds for the installation of a municipal lighting plant.

A garage and boiler house will be built by the New Britain Lodge of Elks, New Britain, Conn.

New coal pockets will be installed at the Lyman school in Westboro, Mass., by the State.

Worthington, Mass., will issue $20,000 bonds for the installation of a new water system.

The Hartford Rubber Works, Hartford, Conn., manufacturer of rubber tires, will build an addition to plant.

Joseph E. Brierly, Rockville, Conn., will erect a dry-cleaning plant which will be furnished with modern equipment.

Work has been started on an addition to the plant of the Beebe & Richards Rubber Company, North Brookfield, Mass.

Littauer Brothers, glove manufacturers, of Gloversville, N. Y., will establish a branch factory on Spring street, Williamstown, Mass.

The American Hide and Leather Company, of Lowell, Mass., will erect an addition to its plant for a beam and hide house to cost over $100,000.

Contract has been awarded for construction of new dairy building for the Massachusetts Agricultural College, Amherst, Mass. Ice and dairy machinery will be installed.

The Jacobson-Brandow Company, Pittsfield, Mass., manufacturer of spark coils, will increase its capital $50,000 to enlarge its plant to double the present capacity.

Robert Jones, of West Pawlet, Vt., and H. H. Perry, of Fairhaven, Vt., have leased a 150-acre tract of land known as the Greene property at North Poultney, Vt., and will open a new slate quarry.

The American Emery Wheel Works, Providence, R. I., is erecting an addition which will greatly increase its manufacturing facilities and storage room. Orders for equipment needed have been placed.

The New England Waterpower Company, Boston, Mass., will issue $3,750,000 stock and bonds for the installation of a hydro-electric power plant near Shelburne Falls, Mass., to yield about 25,000 horsepower.

The Cocheco Print Works, of the Pacific Mills Corporation, Dover, N. H., will move its plant into a new print-works plant now under construction in Lawrence, Mass. The company contemplates installing a gingham mill in the plant at Dover, after the removal of the print works.

MIDDLE STATES

J. H. Miller is having a broom factory erected at Hamburg, Penn.

Justin Means, of Edgar, Wis., will erect a box factory, also excelsior plant.

The city lighting plant owned by W. J. Gavin at Chetek, Wis., was burned.

The Ohio Boxboard Company, of Cleveland, O., will erect an addition to its plant.

The Oswego Candy Works is building a new and larger factory in Oswego, N. Y.

The Elwell-Parker Electric Company, Cleveland, O., will build addition to factory.

The Beaver Canning Company, of Beaver Dam, Wis., is erecting new complete plant.

Fire destroyed the window sash and blind factory of Hershovitz Brothers, Hoboken, N. J.

The Glens Falls (N. Y.) Plug Works were destroyed by fire, entailing a loss of $10,000.

The Smith Dye Works will install a boiler at 521 Massachusetts avenue, Indianapolis, Ind.

The A. M. Welti & Brother, of Cleveland, O., cooperage plant was partly destroyed by fire.

The Cleveland Electric Illuminating Company, Cleveland, O., will erect a new boiler house.

East Liverpool (Ohio) Ice Company will build an artificial ice plant. J. W. Gaston, president.

The Mica Insulator Company, of Schenectady, N. Y., has decided to increase the size of its plant.

The Excelsior Electric Light Company, of Sellersville, Penn., will build a large addition to its plant.

The Minetto-Meridan Company, Minetto, N. Y., is preparing to increase its water-power plant.

The Black Diamond Vinegar Works, at Stroudsburg, Penn., was destroyed by fire. Loss, $40,000.

The silk factory of William McCrum, at West Paterson, N. J., was destroyed by fire. Loss, $20,000.

The Cincinnati Traction Company will build a two-story substation on Reading road, Cincinnati, O.

The lumber plant of the Farrin-Korn Company, Cincinnati, O., was destroyed by fire. Loss, $150,000.

Fire burned the plant of the Prairie State Incubator Company at Homer City, Penn. Loss, $150,000.

The Corcoran Lamp Company, Cincinnati, O., will erect a four-story factory at 712 to 720 Reading road.

The Wisconsin Pea Canning Company is considering the erection of another factory at Milltown, Wis.

The Philadelphia & Reading Railroad has let contract for a power house to be erected at St. Clair, Penn.

The Tiona Refining Company, Meridian street and Belt railroad, Indianapolis, Ind., will install a boiler.

The Pfister & Vogel Leather Company, of Milwaukee, Wis., will erect patent leather factory at South Milwaukee.

The Chicago (Ill.) Leather Manufacturing Company, 628 West Twelfth street, will build a one-story addition.

The Amsterdam Broom Company, Amsterdam, N. Y., is planning to build an addition to its plant this fall.

The Massillon Brewing Company, of Massillon, O., will soon start the erection of a $30,000 bottling plant.

The plant of the Detroit Garbage Reduction Company at French Landing, Mich., was destroyed by an explosion.

A large creamery at Dunkirk, N. Y., owned and operated by Lavern Derby, of Cassadaga, was burned. Loss, $8000.

The town of Big Rapids, Mich., is considering the erection of a dam and municipal power plant for electric power.

The plant of the Henke Furniture Company, of Cleveland, O., which collapsed several months ago, will be rebuilt.

The County Traction Company's power house, Haroz and Lake streets, Oak Park, Ill., was damaged by fire. Loss, $10,000.

The Knickerbocker Ice Company will build a $375,000 plant at Gary, Ind., including storage houses and an 80-ton ice plant.

Shuttleworth Brothers, carpet manufacturers, of Amsterdam, N. Y., expect to erect another large addition to their mills.

The plant of the M. B. Farrin Lumber Company, Winton place, Cincinnati, O., was damaged by fire to the extent of $250,000.

The Gary & Hobart Traction Company has been granted a permit to enter Gary, Ind., and will build a power station there.

The Stewart Electric Company, Philadelphia, Penn., will erect a six-story building to be used as an additional factory.

The Bedford Harrow-Drag Company, Bedford, Ind., has secured a factory site and will soon begin the erection of buildings.

The mechanical equipment at the New Albany Box and Basket Company's factory, New Albany, Ind., was damaged by fire recently.

The cold-storage plant of G. Lang's brewery at 400 Best street, Buffalo, N. Y., will be enlarged and altered at a cost of $20,000.

The Standard Furniture Company, Herkimer, N. Y., has purchased additional ground and will enlarge its plant in the near future.

The Gregg Carriage Company has let contract for a four-story addition to its plant at Nineteenth and Arch streets, Philadelphia, Penn.

The Crawford McGregor and Canby Company, of Dayton, O., manufacturers of shoe last and bowling-alley equipment, will enlarge plant.

The Keystone Plating and Manufacturing Company has leased the three-story factory at Fourth and Cherry streets, Philadelphia, Penn.

The city of Philadelphia has let contract for a laundry building for the Philadelphia Hospital and will install some laundry machinery.

H. C. Hemingway & Co., Auburn, N. Y., have purchased a large building at Lyons, N. Y., and will equip it for canning fruit and vegetables.

The Philadelphia Rapid Transit Company has started to erect a power station at 1823-29 East Letterbury street, Philadelphia, to cost $33,000.

The Presbyterian Orphanage has let contract for a power house to cost $10,000 at Fifty-ninth street and Chester avenue, Philadelphia, Penn.

The Pennsylvania Salt Manufacturing Company will erect a two-story mill house at Delaware avenue and Shunk street, Philadelphia, Penn.

The Auto City Brewing Company, of Detroit, Mich., has just completed its new plant and is now erecting a bottling plant. Will need equipment.

The United States Construction Company, of St. Louis, Mo., is building a large concrete building for the Ohio Cultivator Company at Bellevue, O.

Henry Schmer, of Syracuse, N. Y., contemplates an addition to his box factory on Knoxon street, that city, that will double the capacity of his plant.

The Christian Schmidt & Son Brewing Company has let contract for a three-story addition to plant at Edward and Hancock streets, Philadelphia, Penn.

The Concrete Products Company, Cleveland, O., organized to make concrete products, will require equipment for new plant. J. Adler and W. T. Black.

A new sugar-beet factory will be erected at Ottawa, O., with 600 tons capacity, to

take care of 1912 crop. Inquire Findley Board of Trade (Ohio) for name.

A. H. and F. H. Lippincott, Philadelphia, Penn., manufacturers of soda-water apparatus, have started construction of a new reinforced-concrete factory building.

The General Carbonic Company will move from Saratoga Springs to Albany, N. Y., where a plant to cost about $75,000 will be erected, for use in compressing carbonic gas.

The Goldschmidt Detinning Company, of New York, has decided upon a piece of property at East Chicago, Ill., and will erect a large plant for detinning purposes.

The city of Cleveland, O., will erect new power plant, bake shop and laundry at the boys' school to take place of ones recently destroyed by fire. H. B. Briggs, architect.

The Defiance Packing Company, Defiance, O., has been organized with a capital of $50,000 to do a general packing business by F. G. Miller, C. J. Chandler, B. F. Enos, etc.

The H. H. Sheip Manufacturing Company, manufacturer of cigar boxes, etc., will erect a three-story addition to its plant at Sixth street and Columbia avenue, Philadelphia, Penn.

The Maynard Piano Company, Chicago, Ill., will build a new three-story brick factory at Thirty-Seventh and Loomis streets, and equip it throughout with new machinery and power plant.

The American Concrete Tile and Pipe Company, of New York, is negotiating for the location of a plant for the manufacture of reinforced concrete, tile, etc., at Tomkins Cove, N. Y.

The Krell Piano Company, Cincinnati, O., has been organized with $550,000 capital to manufacture and sell pianos, player pianos, etc., by Albert Krell, Edward B. Pfan, George R. Oesfer, etc.

Summitt Rubber Company, Barberton, O., has been incorporated with $50,000 capital to manufacture rubber articles of all kinds by O. L. Dickerhorf, L. J. Johnson, Walter Seiberling, etc.

The Idealite Company, South Bend, Ind., has been incorporated with a capital of $100,000 to manufacture artificial marble. Directors, G. B. Pulfex, Mentor Wetzstein and G. B. Hopkins.

Fire destroyed the storehouse and grain elevator of the Eaton Buckwheat Milling Company at Eaton, Madison county, N. Y. The concern does the largest buckwheat milling business in the State.

Oneida Community Company, Limited, is erecting a large addition to its plant at Sherrill, N. Y. Animal traps, chains, silk thread and canned fruits and vegetables are manufactured by this concern.

The plant of the E. I. DuPont Powder Company at Pleasant Prairie, Wis., destroyed by explosion some months ago, is being rebuilt. Power-plant equipment and machinery of various kinds will be required.

Charles H. Vendig is having plans posted for a 12-story hotel, to be called the New Vendig Hotel, to be erected at Twelfth and Filbert streets, Philadelphia, Penn. Will install a power and heating plant.

The Graham Bottle Machine Company, Muncie, Ind., has been incorporated, with a capital stock of $100,000, for the manufacture of glass bottles and jars. Incorporators, Joseph B. Graham, W. C. and Geo. A. Ball.

The Smith Lee Company, Oneida, N. Y., manufacturing milk bottle caps, is running to capacity and it is reported that additional machinery will be installed in the near future. About 60 men are employed.

The Standard Concrete Company, of Poughkeepsie, N. Y., with $30,000 capital, has been incorporated to manufacture artificial stone and concrete products. Directors, William Knauss, Gottlieb Bahret and Everett Travis.

The Geneva Malting Company, capital $100,000, has been formed at Geneva, N. Y., and proposes to operate the old malt houses formerly owned by S. K. Nester. Same are now being put into shape for opening this fall.

The Gregg Carriage Company and the William D. Rodgers' Son Company, both of Philadelphia, have formed a consolidation under the name of the Gregg-Rodgers Company, and will build a large addition to the Gregg plant on Arch street.

The Premier Broom and Brush Company has been incorporated at South Amsterdam, N. Y. Will remodel a building at that point and will engage in the broom industry as soon as the new crop of broom corn is ready for market.

The Hemingway Company, Lyons, N. Y., has purchased the plant formerly occupied by the Lyons Beet Sugar Refining Company, for a canning and preserving plant. Equipment will be installed so that operations can commence next spring.

The L. A. Strobel Company, manufacturer of moldings and picture frames, has secured a site at Mitchell avenue and the C. H. & D. railway, Winton place, Cincinnati, O., and will expend $100,000 in erecting and equipping a five-story factory building.

The Graham Bottle Manufacturing Company, Muncie, Ind., has been incorporated with a capital of $100,000 by Joseph B. Graham, William C. and George A. Ball (of the Ball Brothers Glass Fruit Jar Company) to manufacture glass bottles.

The Humane Rubber Horseshoe Company, of Montgomery, N. Y., has purchased the old glue factory at Fishkill Landing, N. Y., and after making necessary improvements will occupy same, manufacturing rubber horseshoe pads and automatic tires.

The Eagle Paper Mill Company, Franklin, O., which has been closed for a number of years, is to be started again. A. B. Smith, of the P. A. Sorg Paper Company, of Middletown, O., will be the head of the new concern. New machinery will be required.

Schenck and Williams, architects, of Dayton, O., are making plans for a factory building to be erected in Toledo, O. To be known as the Toledo Factories Building. It is to be four stories, and will be equipped with modern power, heating and lighting plant.

A plant for the manufacture of sash weights, flue wings, elevator weights, tampers, iron horse hitchers, brake shoes and similar commodities is to be erected in Girard, Ohio, by a newly formed company, of which O. A. Potts, of Youngstown, Ohio, is to be manager.

The Kewanee, Bradford & Henry Interurban Railroad has been incorporated to build a railroad from Kewanee to Henry, Ill. Incorporators, John P. Code, Bradford, Ill.; John Brady, Kewanee; Howard G. Stoner, Henry, Ill., and Harry H. Hines, Peoria, Ill.

A new shoe factory will be built and equipped at Lawrenceburg, Ind., by the Frolicher-Helmers Shoe Manufacturing Company, of Cincinnati, O. This concern was recently organized by Emil A. Frolicher, E. F. Frohlicher and Albert Helmers, all of Cincinnati.

The Brewers' Bottle Case Association, recently organized with $100,000 capital as successor to the Bay Shore Manufacturing Company, Sandusky, O., has leased a plant at Deubel avenue and the Big Four railroad, Cincinnati, O., and will remove its shop to that point.

A new plant for the manufacture of artificial fertilizers will be built at St. Bernard, O., a suburb of Cincinnati, by the Virginia-Carolina Chemical Company, Richmond, Va. Plans have been prepared by the company's own engineers and work of construction will be begun immediately.

It has been previously reported that J. Spaulding & Sons' Company, paper manufacturers, of Rochester, N. H., will locate a plant at Tonawanda, N. Y., and the contract for the erection of same has now been let to the Aberthaw Construction Company, of Boston. The plant will consist of a main building, 300x265 feet, one story high except for 60 feet of its length, which will be two stories high. There will also be a one-story machine shop, 144x36 feet, and a one-story acid-boiling plant, 72x36 feet, also a power house. It is expected that buildings will be completed for the fall.

SOUTHERN STATES

Nuttallburg (W. Va.) Coal and Coke Company is to build a new tipple.

The Charleston Consolidated Gas, Electric and Railway Company at Charleston, S. C., will shortly begin the building of the new power house and will be in the market for equipment.

Fire partially destroyed the plant of the Ohio Scroll and Lumber Company at Russell avenue and Stewart street, Covington, Ky., with considerable resulting loss to machinery and patterns.

A tract of land in Shadyside, W. Va., has been granted W. T. Hughes, secretary of the Ohio Valley Enamel Company, and W. C. Stewart, of Moundsville, who recently purchased the controlling interest in the Novelty Stamping Company, for the erection of a new plant.

WEST OF THE MISSISSIPPI

Disbrow & Jackson are planning the erection of a piano factory at Atlantic, Ia.

The John Gund Brewing Company will erect cold-storage plant at Sioux Falls, S. D.

The electric-light plant at Clarion, Ia., owned by Carr & Mozingo, was burned. Loss, $8000.

The Independent Soap Company is contemplating the erection of a factory at Fort Dodge, Ia.

The Western Packing Company, Spirit Lake, Ia., will at once rebuild plant recently destroyed by fire.

H. A. Hassam, of North Yakima, Wash., is planning to install a concrete pipe factory at Prosser, Wash.

The Artesia (N. M.) alfalfa mill has been acquired by Larsh Brothers. The capacity of the plant will be increased and new machinery installed.

The Mt. Hood Railway and Power Company, Portland, Ore., plans for the erection of its proposed car shops on a site selected at Gresham, Ore.

The Shenandoah Ice, Heat, Light and Power Company, Shenandoah, Ia., will install a new boiler and a 250-kilowatt generator and engine.

The California Incandescent Lamp Company, Los Angeles, Cal., has been incorporated by H. P. Oates and J. E. Bowen, with a capital of $100,000.

The brick-manufacturing plant of the Builders Brick Company, Seattle, Wash., was partially destroyed by fire. The damage will be repaired at once.

The Street Railway Company, Des Moines, Ia., J. R. Harrigan, general manager, will install a new low-pressure turbine as well as rotary converters.

The Bixby Estate, Long Beach, Cal., has taken out a permit to erect a new refrigerating addition to its plant on Stephenson avenue, Los Angeles.

J. F. Bradley and G L. Miller, San Francisco, Cal, are having plans prepared for a soap-manufacturing plant. Modern machinery will be installed.

The El Ranchito Citrus Association, Whittier, Cal., recently incorporated, will build a new fruit-packing plant. Modern machinery will be installed.

Anthony Keith, Elsinore, Cal., is having plans prepared for a commercial garage and automobile machine shop. Modern equipment will be installed.

The Multnomah Mill and Construction Company, Portland, Ore., has acquired a new site, and plans for the erection of a modern wood-working plant.

The Riverside (Cal.) Portland Cement Company will expend about $225,000 on improvements and extensions to its large plant, during the coming year.

The American Beet Sugar Company will expend $150,000 on new machinery and other improvements at its plant at Grand Island, Neb. Mr. Swan, manager.

The Mt. Whitney Power and Electric Company, Visalia, Cal., will build a new power plant on West Main street. Contract for the building has been awarded.

David C. Strong, Los Angeles, Cal., is planning for the erection of a starch-manufacturing plant near Bakersfield. Modern equipment will be installed.

The city of Toppenish, Wash., will call for bids in October for a new sewerage and drainage system. A bond issue will be voted. D. R. Redman, city engineer.

The Rosenberg Packing Company, Yuba City, Cal., plans for the erection of a new fruit-packing house at Fresno. C. M. Rand is manager of this company.

The ice-manufacturing plant of the O. McHenry Meat Company, Modesto, Cal., was destroyed by fire. Loss estimated at $75,000. The plant will be rebuilt.

The Coalinga (Cal.) National Petroleum Company has commenced the erection of an oil-refining plant. The plant will be fully equipped with modern machinery.

The Pacific Board and Paper Company, Seattle, Wash., located on Lake Union, will double the capacity of its present plant. New machinery will be installed.

The Ciara Consolidated Mining Company, Swansea, Ariz., plans for the erection of a slag steam-generating plant, utilizing the waste heat in the slag for steam.

Power-plant equipment will be installed in the seven-story Plaza hotel to be erected at El Paso, Tex. Estimated cost, $150,000. Trost & Trost, architects, El Paso.

The San Francisco (Cal.) Gas and Electric Company has taken out a permit to build an addition and make improvements in its power plant, station "D," on Bush street.

Bly & Rooser have acquired the cotton-ginning plant of L. L. Stephson, Big Springs, Tex. The capacity of the plant will be increased and new machinery installed.

Power-plant equipment will be installed in the new nine-story building to be erected by the Masonic Temple Association, Sacramento, Cal. Estimated cost, $500,000.

The Purified Oil Company, El Paso, Tex., recently incorporated, has commenced the erection of building for its new oil-refining plant. The plant will be fully equipped.

The Fidalgo Island Fire Clay Company, Anacortes, Wash., contemplates the erection of a new manufacturing plant for clay specialties. About $125,000 will be expended.

In connection with its new codfish-canning plant, now building at Paulsbo, near Seattle, the Pacific Coast Codfish Company, Seattle, Wash., will build a box-manufacturing plant.

The Kellogg Refining Company, Los Angeles, Cal., is planning for the erection of an oil-refining plant at Richfield, Orange county. Modern machinery will be installed.

Transmission lines, conveying machinery, wood fuel cutting and storing machinery, of the Oregon Power Company, Springfield, Ore., were destroyed by fire. Loss, $20,000.

The Pacific Light and Power Company, Los Angeles, Cal., will increase the capacity of its power plant in the San Gabriel cañon. A new transmission system will be installed.

The Pacific Telephone and Telegraph Company, San Francisco, Cal., has had plans prepared for a new plant at Vernon avenue, Los Angeles. The plant will be fully equipped.

The Barber Asphalt Paving Company, Pasadena, Cal., has taken out a permit to build a new plant; an engine house is included in the plans. Modern equipment will be installed.

The Daybreak Oil Company, Bakersfield and Midway field, Cal., recently incorporated, is planning to install oil-drilling machinery at its properties. J. B. Hedrick is head of this company.

The Washington Brick, Lime and Sewer Pipe Company, Spokane, Wash., will establish a plant at Freeman, Wash., with a daily capacity of 100,000 bricks. The plant will be fully equipped.

Power-plant equipment will be required in the new apartment hotel to be erected in the King's Hill section, Portland, Ore. Estimated cost, $300,000. Bennes & Hendricks, architects, Portland.

The California Glass Insulator Company (Robert P. Frift, manager), Los Angeles, Cal., is planning for the erection of a plant for the manufacture of its specialty at Redondo beach.

Power-plant equipment will be installed in the new seven-story hotel to be erected by the Royal Investment Company, San Francisco, Cal. Estimated cost, $150,000. C. P. Weeks, architect, San Francisco.

The Palmer Oil Company, Sisquoc, San Luis Obispo county, Cal., is having plans prepared for a large asphalt-refining plant. The plant will be fully equipped. About $150,000 will be expended.

A. W. Savage, head of the Savage Tire Company, Monrovia, Cal., recently incorporated, contemplates the erection of a plant for the manufacture of his patented automobile tire at San Diego, Cal.

C. E. Anthony, San Diego, Cal., is at the head of a company which will build a large vitrified brick and pipe-manufacturing plant on Division street. The plant will be fully equipped with modern machinery.

Power-plant equipment will be required in the new 8-story hotel to be erected by the Regents of the University of California, at San Francisco. Estimated cost, $500,000. Willis Polk, architect, San Francisco.

O. W. Thomas, Los Angeles, Cal., is having plans prepared for an addition to his dye works plant. A new drying house, boiler house and cleaning plant will be erected. Modern equipment will be installed.

The Home Brewing Company, San Diego, Cal., recently incorporated, plans for the erection of a modern brewing plant. The plant will be fully equipped. G. W. Clayton, San Francisco, is interested in this company.

Power-plant equipment will be required in the new 10-story office building to be erected by H. E. Huntington for the Los Angeles (Cal.) Railway. Estimated cost, $1,250,000. Myron Hunt, architect, Los Angeles, Cal.

The Chuckawalla Development Company, The Tallant-Grant Packing Company, Astoria, Ore., is planning for the erection of a new fish-canning plant on the Eel river. N. W. Tallant is head of this company.

The Spokane (Wash.) Asbestos Fire Brick Company is planning for the erection of a manufacturing plant for its product in this vicinity. A second plant is contemplated at Kamiah, Ida., near its asbestos deposits. Both plants will be fully equipped. R. P. Kringle is interested in this company.

CANADA

Raymond, Alberta, will extend its waterworks system.

Port Stanley, Ont., will equip a hydro-electric power plant.

Winnipeg will buy electrical equipment for a new power station.

Woodstock, Ont., will make important additions to its waterworks.

St. Jerome, Quebec, will equip a new electric light and power plant.

Toronto, Ont., will spend $200,000 for additions to the waterworks.

The Independent Tire Company will equip a complete factory at Guelph, Ont.

Gravenhurst, Ont., will make important extensions to its waterworks system.

The General Storage Company expect to equip a new $400,000 plant at Port Arthur, Ont.

The National Biscuit Company, of Vancouver, will build a big addition to its factory.

The Pattinson Woolen Mills, Preston, Ont., will be doubled and latest machinery installed.

Rockwood & Co., of New York, will locate a big chocolate manufacturing plant in Toronto.

The Oshawa Brick Company will build a new plant at Oshawa, Ont. William Lowe, manager.

The Riordon Paper Company's plant at Calumet, Que., was destroyed by fire. Loss, $200,000.

Fire did $35,000 damage to the door factory of J. A. O'Brien & Co., Craig street, Montreal.

The Northern Telephone and Power Company are to erect a new plant at Fort George, B. C.

The Spectator Publishing Company, of Hamilton, Ont., will buy a lot of the most modern machinery.

The Monarch Knitting Company, of St. Thomas, Ont., will double its plant and buy new machinery.

Calgary, Alberta, will build 27 miles of new water mains and buy new waterworks pumping machinery.

The Sherbrooke Railway and Power Company, of Sherbrooke, Quebec, will make extensions to its plant.

Large additions are contemplated by the National Transcontinental repair shops, Transcona, Manitoba.

The Herald Printing Company, of Hamilton, Ont., will buy a large quantity of new machinery of the latest type.

The Alberta Electric Railway will build a new line to Carbon, Alberta, and will buy new oil engines and equipment to use on it.

H. K. Ruttan, Winnipeg, is calling for tenders for equipment for a new complete waterworks system for Deer Lodge, Assiniboia.

The Dominion Sugar Company, Wallaceburg, Canada, will equip a large factory at Chatham, Ont., and will purchase crushing machinery for beets, etc.

Complete electrical machinery for lighting and operating all elevators and other apparatus will be purchased for the new $1,000,000 station to be built at Quebec City. Messrs. Marchand & Tanquay, Quebec, are in charge of the work.

FOREIGN

The Calumet & Sonora Mining Company, Sonora, Mex., will install an electric-lighting and power plant.

BUSINESS ITEM

Construction of the new plant of the Rockford Machine Tool Company, Rockford, Ill., is progressing rapidly, and is expected to be ready for occupancy by October 1. The building is of reinforced concrete construction, and is to be modernly equipped with handling and other apparatus. The main building is to be 100 feet wide by 200 feet long.

FORTHCOMING MEETINGS

National Machine Tool Builders' Association. Annual convention, New York City, October 10 and 11. Chas. E. Hildreth, secretary, Worcester, Mass.

The National Supply and Machinery Dealers' Association, annual convention, New York City; October 10 and 11.

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Welles tools. Welles Caliper Co., Milwaukee, Wis.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Special machinery designed and built to order; tools, jigs, fixtures, sheet metal tools and stampings. Frank J. Dyett Co., Ilion, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Specialties to manufacture; uptodate brass foundry and machine shop; automatic machinery, etc. Edward Schroeder Lamp Works, Jersey City, N. J.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Wanted—A manufacturer or designer to build a set of machines for the manufacture of flexible steel armored conduit; give particulars in detail to Kempf, Box 262, AMER. MACHINIST.

Wanting to interest party in splendid line, heavy machinery, manufacturing proposition, large, and increasing demand in this, and foreign countries, no experimenting. Address, Box 249, AMERICAN MACHINIST.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Patents—An able mechanical engineer will see and protect technical points better; valuable suggestions and assistance in developing inventions. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraph Company, Baltimore, Md.

Peck's "Sure" center finder goes on tailstock center of lathe and finds drills and countersinks a center in work held and revolving in lathe chuck; made in four sizes, drill diameters 1/4, 5/64, 1/16 and 3/64 inches; by mail postpaid on receipt of 65c. each size. W. A. Peck, 141 Brewery St., New Haven, Conn.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

ALABAMA

Wanted—A-1 all-round machinist for contract shop; steady job for right man; none but first-class workman need apply. Tuscaloosa Iron Works, Tuscaloosa, Ala.

CANADA

Wanted—First class general foreman for a works manufacturing street railway special work. Box 218, AMERICAN MACHINIST.

Wanted—First class metallurgist; one especially posted on manganese steel castings, and willing to go to Canada. Box 217, AM. MA.

Wanted—A first-class toolmaker with good executive ability to take charge of small tool room; man familiar with machine tool work preferred; write stating experience, age and salary required to the John Bertram & Sons Company, Ltd., Dundas, Ont.

Wanted—A practical mechanical partner with ten thousand dollars capital to invest in a prosperous well established business; no incumbrance; requirements: the production of interchangeable tool parts and marine motors. Apply P. O. Box 682, Montreal, Canada.

CONNECTICUT

A live salesman wanted to handle a new pipe threading tool; good proposition to right man as a side line. Address Box 698, Bridgeport, Conn.

INDIANA

Wanted—Draftsman to make patent office drawings in a city in Middle West; give references and experience. Box 264, AMER. MACH.

Wanted—Foreman who has had experience in assembling clocks, typewriters, or other small parts; good opportunity for sober, energetic young man; factory in small Indiana town; state past experience very fully. Box 112, Anderson, Ind.

Wanted—Foreman and several first class toolmakers for tool room, making punching and forming dies and jigs and fixtures for gas engine work. Apply by letter, giving complete information as to experience, references, etc. Box 219, AMERICAN MACHINIST.

Wanted—A few skilled toolmakers by a well established manufacturing firm, located in Indiana; applicants must be of high character and enterprising in their work; state character of work best skilled in, age, experience and give references. Box 170, AM. MACH.

Wanted—We employ Cleveland and Brown & Sharpe automatic turret forming machines, Potter & Johnston and Jones & Lamson turret lathe, also automatic gear cutting machines; we want a man skilled in the operation of some or all of the above, who is thoroughly qualified to operate and superintend to best advantage. Address, stating age, experience and give references. Link-Belt Company, Indianapolis, Ind.

IOWA

Wanted—Draftsmen experienced on steel and wood car construction; steady work for the right men. Box 236, AMER. MACHINIST.

Wanted—Machine shop foreman; must be competent to manage men, thoroughly experienced in operating all kinds of heavy machine tools and well informed on modern machine shop methods; in making application give age, experience and references. Box 260, AMERICAN MACHINIST.

KANSAS

Wanted—Experienced machinists for fine work on gasolene engine construction. Box 267, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—First class car draftsmen, preferably with wood and steel car experience; none but first class men need apply. Osgood Bradley Car Company, Worcester, Mass.

Wanted—Cost clerk for manufacturing concern, with actual experience in cost finding of quantity production parts; man with technical knowledge preferred; give detailed experience, places and periods of employment, references, age and salary expected. Address "Clerk," Box 1574, Springfield, Mass.

Wanted—One or two strictly first class machinists; men with experience in installing printing machines or similar automatic machinery; must be able to furnish first class references as to ability and character and willing to go anywhere in the States or Canada for installations; to such men we can offer good, steady positions and good pay with a chance for promotion. Apply, "C. S. P.," AMERICAN MACHINIST.

MICHIGAN

Toolmakers wanted at once—Several men experienced on tools, jigs and fixtures; first-class men only need apply. Buick Motor Company, Flint, Mich.

Wanted—First class man to take charge of automatic department using multiple spindle machines on all kinds of automobile parts and small accurate work; must be uptodate in the latest designs of tools and able to produce quality and quantity; give references and wages expected. Box 240, AMER. MACH.

MISSOURI

We have openings for two or three first-class wood patternmakers; good wages and permanent positions for highly skilled men. Curtis & Co. Manufacturing Company, St. Louis, Mo.

Wanted—Head foreman, first class; man who has been assistant to high-grade superintendent in large works and understands modern shop practice; state age, experience, reference and salary expected. Blumenstock Brothers Advertising Agency, 1610 Chemical building, St. Louis, Mo.

NEW JERSEY

Working foreman to take charge of tool room for the manufacture of metal specialties; only thoroughly competent men need apply; state salary and former experience. J. Chein & Co., 310 Passaic Ave., Harrison, N. J.

Wanted—Toolmakers, Jones & Lamson and Gisholt operators, and general machine tool hands; good pay, steady employment; mail application, giving wages at last place. Crane Motor Car Company, 96 West Seventh Street, Bayonne, N. J.

Draftsman wanted for city in New Jersey, ten miles from New York; one familiar with drawings for fine tool work; also draftsman conversant with tool layout for Brown & Sharpe automatic screw machine work. Box 230, AMERICAN MACHINIST.

Tool and jig designer wanted; must be a thorough practical shop man, capable of making sketches and drawings; permanent position for the right man; location near New York City in machine works employing 2000 hands. Box 238, AMERICAN MACHINIST.

Capable man wanted to take full control of jig and tool designing, and their manufacture; must be an experienced man; able to arrange plans and methods of production of a high-class product, consisting of many small parts; permanent position to a suitable man; in writing, state fully and clearly your qualifications, experience, age and salary required, to Box 268, AMER. MACH.

NEW YORK

Machinist—A first class toolmaker, competent to manufacture a small metal device; very accurate work required. Box 222, AM. M.

Wanted—Clever salesman who understands and can sell presses, etc.; familiarity with sheet-metal work required; good salary for competent man. Niagara Machine and Tool Works, Buffalo, N. Y.

Wanted—Tool steel salesmen for all States to sell a leading brand of high-speed and carbon steels; write, giving particulars, age, salary expected, experience, territory covered, to Box 259, AMERICAN MACHINIST.

Foreman for gear cutting department; must be first class and thoroughly experienced on high-grade automobile work, such as bevels and spurs, and one who understands the operation of Gleason, Bilgram and Brown & Sharpe machines; none others will be considered. Box 257, AMERICAN MACHINIST.

We are enlarging our shop and invite applications from clean, hustling machinists, floor men, and machine operators, with experience in producing close work rapidly; also one man for small tool maintenance; good town, growing shop, good wages, and a premium system that pays. Kerr Turbine Company, Wellsville, N. Y.

Wanted—Machinery salesman, live and energetic, with theoretical and practical experience in gear cutting, for selling high grade, well known line of modern gear cutting machines; first class opportunity for capable hustler; state age, salary desired, former experience and territory covered; only men with thorough experience in gear cutting line will be considered. "S. G.," AMER. MACHINIST.

OHIO

Designer, experienced in dies, tools and automatic machinery, wants position. Box 220, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—Vise hands and erectors. Eclipse (Motor) Truck Co., Franklin, Penn.

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 208, AMERICAN MACHINIST.

Wanted—An experienced foundry foreman for a steel foundry doing miscellaneous work; applicant must be competent to estimate piece rates; state age, experience and salary expected; also send references. Box 261, AMERICAN MACHINIST.

Wanted an instructor in mechanical engineering; salary, $1200 per total work of college year; applicant should want to teach always, should be graduate of two years' standing of some high-grade technical college; he should have mastery of the principle of elementary mechanics, have good scholastic record; college work begins Sept. 20, 1911; send references, experience, etc., to Mechanical Engineering, South Bethlehem, Penn.; before closing, personal interview necessary.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

TENNESSEE

Draftsman for structural work and mining machinery, consulting engineer's office; state age, experience and salary expected. "M. & W." Care of AMERICAN MACHINIST.

WASHINGTON

Wanted—An assistant foreman, young and uptodate, who understands sawmill and engine work, to have charge of floor and bench hands; from 15 to 30 men under him; good job for the right man. Address, Sumner Iron Works, Everett, Wash.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CALIFORNIA

Toolmaker desires change, swift, accurate man, 16 years' experience tools, dies, jigs, special machines, instruments. Address care of Gables, 1449 Second street, San Diego, Cal.

CANADA

Superintendent or general foreman; good organizer and uptodate in factory efficiency; United States or Canada. Box 250, AMERICAN MACHINIST.

Mechanical engineer, 15 years' experience, desires change about September 1; good executive, both factory and office experience; reducing cost and raising standard of production a specialty. Box 253, AMER. MACH.

CONNECTICUT

Foreman toolmaker desires change; press tools, wire forming and screw machine tools and novelty work in general; a good all-round man with 20 years' experience. Box 263, AMERICAN MACHINIST.

ILLINOIS

Englishman employed on the road by firm of Chicago jobbers—mill supplies—seeks similar connection with firm manufacturing representative line; technical education; excellent sales record. Box 234, AMERICAN MACHINIST, 122 So. Michigan Blvd., Chicago, Ill.

Automatic screw machine foreman who knows what an automatic can do; a man who can get production and quality that will please is open for a position; familiar with Brown & Sharpe, Acme, Gridley, Cleveland and Hartford machines. Box 252, AMERICAN MACHINIST.

Executive desires position: 13 years' experience with large manufacturing concerns; piece work, premium and standard time systems; A-1 mechanic; good manager and a hustler; open for immediate engagement; age 36; best of references. Box 255, AMERICAN MACHINIST.

Superintendent desires change; prefer East or Middle West; graduate mechanical engineer; 12 years in official position; thoroughly familiar with design and construction of locomotives and general machinery; good organizer; familiar with piece work and bonus system; member A. S. M. E. Box 254, AMER. MACHINIST.

MASSACHUSETTS

Practical mechanic, expert designer of tools and special machinery, with extensive experience and executive ability, desires responsible position. Box 214, AMERICAN MACHINIST.

Responsible position by mechanical engineer and designer; technical education; 11 years' experience on automatic machinery; has held position of chief draftsman; now employed. Box 265, AMERICAN MACHINIST.

American, age 40, inventor and practical mechanic; 22 years' experience as superintendent, foreman, chief designer on drop-forge dies, and sheet-metal dies of every description; complicated and special machinery; 16 years with large company; now employed; hustler, and never failed to meet all expectations; references furnished. Box 247, AMER. MACHINIST.

MICHIGAN

Superintendent is seeking new field; I can produce and know how it should be done; I have been with some of the largest factories in this country, and can furnish reference; 22 years' experience; age, 40. Box 33, AMERICAN MACHINIST.

Superintendent wishes to join automobile or truck company; age, 40, and best of reference; I can systematize your plant and design proper tools to put it on a sound, paying basis, with harmony in all departments. Box 44, AMERICAN MACHINIST.

NEW JERSEY

Efficiency engineer, conversant with theory of uptodate efficiency methods and their practical application, in responsible position, desires change. Box 152, AMER. MACHINIST.

Draftsman, experienced on the design, erection and operation of suction gas producers and gas engines, from 6 to 150 horsepower, desires position; graduate in mechanical-electrical engineering. Box 158, AMER. MACH.

NEW YORK

Successful production engineer, age 35, five years in present position; can reduce cost of medium and light manufacturing; salary, $3000. Box 237, AMERICAN MACHINIST.

Technical graduate, with some years' experience in drafting, office work and construction work in industrial plant and power plant installations, desires to make a change. Box 229, AMERICAN MACHINIST.

Foreman on light and medium work seeks reëngagement or would accept position as machinist with prospects; 12 years' experience; holding excellent references. Allen, 443 East 178th street, New York.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

A class designing draftsman; years experience in developing ideas, designing general and automatic machinery; bookbinding machinery a specialty; New York City or vicinity preferred. Box 270, AMER. MACH.

Mechanical engineer, with executive ability and practical experience that will meet the most exacting requirements in uptodate designing and manufacturing of tools and machinery to increase production. Box 248, AMERICAN MACHINIST.

Designer and engineer; 15 years, developing designing, constructing, installing, automatic and general machinery, tools and fixtures, light, medium and heavy; resourceful and energetic; age 34; executive position; New York or vicinity preferred. Box 256, AMERICAN MACHINIST.

OHIO

Position as superintendent or general foreman of machine shops, accurate, heavy or medium work; practical experience; first-class references. Box 269, AMER. MACH.

Assistant superintendent desires to change, to higher class proposition; 17 years' experience (9 executive) small to medium size accurate work; throughly experienced on costs, systemizing and designing of tools; at present over 600 employees. Box 246, AMERICAN MACHINIST.

PENNSYLVANIA

Draftsman (21) desires change; three years' experience on high-class detail and layout work; moderate salary desired; reference. Box 251, AMERICAN MACHINIST.

RHODE ISLAND

Assistant superintendent with 15 years' experience wishes to engage with progressive manufacturing concern; a position is wanted where unusual ability as designer or production engineer can be used to the utmost advantage; original methods in producing low cost high-grade parts, electrical, hydraulic machinery, machine tools, automatic and special purpose machines, elevators, power transmission machinery, tool work; a high-class executive, inventor, estimator. Box 266, AMER. MACHINIST.

FOR SALE

For sale—One 36"x18' New Haven lathe; old type; in fair condition. Address B. F. Avery & Sons, Louisville, Ky.

Talks With Our Readers

By The Sales Manager

You read the article in last week's issue about the imported tool steel swindle.

You read the ad the week before offering $5000 reward for the detection and conviction of some of these thieves.

The thought came to you then; why are wideawake business men and manufacturers such easy victims?

They are sometimes careless, they do not think, or else like to take a chance.

They forget that the devil loves a sucker, and such swindlers as these are his appointed agents.

Buying unknown, untried, unproven products is a gamble—a gamble that men in responsible charge of machine making plants need not take.

There's one safe rule for every buyer.

Buy from concerns who are doing business in the open, who want your business enough to ask for it.

Yes, concerns who advertise.

These tool steel swindlers did not advertise.

Gum-shoe, gold brick men can't advertise in reputable publications.

Only reliable concerns can advertise in the AMERICAN MACHINIST.

If you need steel, buy from the steel men who advertise in the AMERICAN MACHINIST.

If you need material or equipment of any kind, buy that which is advertised in the AMERICAN MACHINIST.

You're safe then.

It's your assurance of satisfaction—permanent satisfaction.

* * *

Only reliable products can be continuously advertised.

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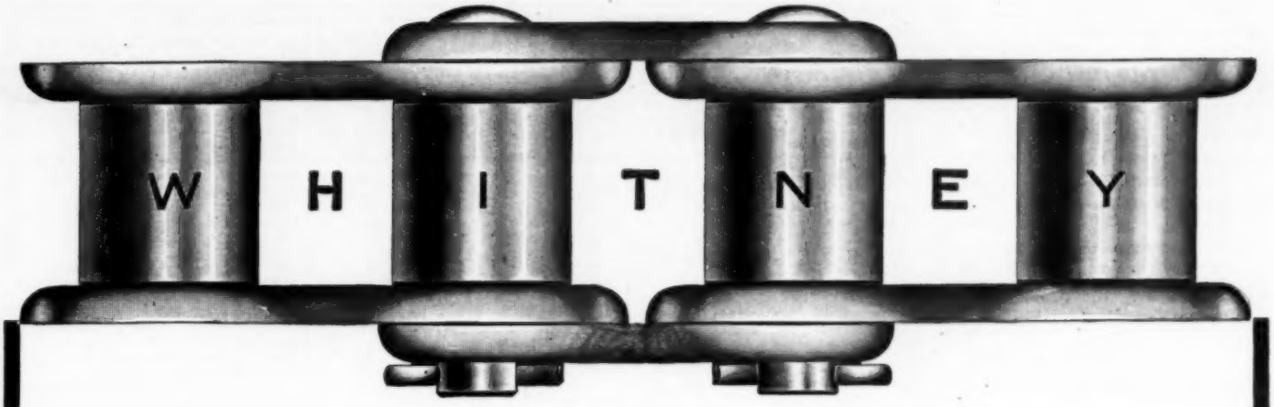

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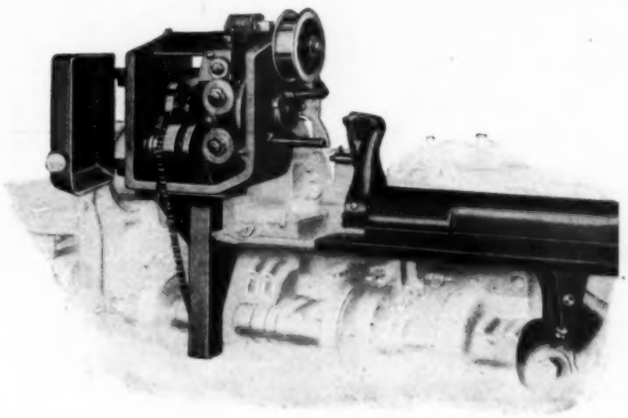
Make and castellate nuts complete on one machine.

B & S Castellating Attachment

For No. 2 Automatic Screw Machine



MANUFACTURERS whose machines require locking nuts have always been troubled by the fact that they could not make them complete on one machine but had to make the nut on one machine and then slot it on another. ¶ Many different devices have been tried without success but this device, a new design recently brought out, has at last solved the problem. ¶ After the nut has been cut, formed and threaded, a transferring arm conveys it to the attachment where the work of slotting is done. All this is quickly and efficiently done, three nuts being slotted at a time.

Other attachments can be furnished for our automatics as follows: Screw Slotting Attachment—for slotting screws automatically; Index Drilling Attachment—for drilling several cross holes in pieces otherwise finished on the machine; Burring Attachment—for drilling, counterboring, facing and burring.

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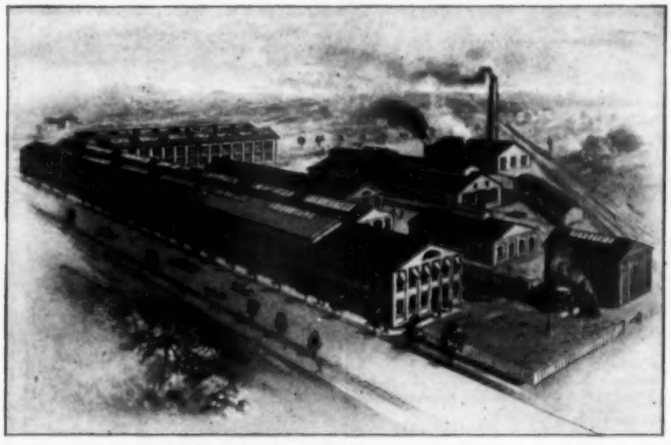

The largest exclusive grinding machine manufactory in the World.

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—EMERSON.

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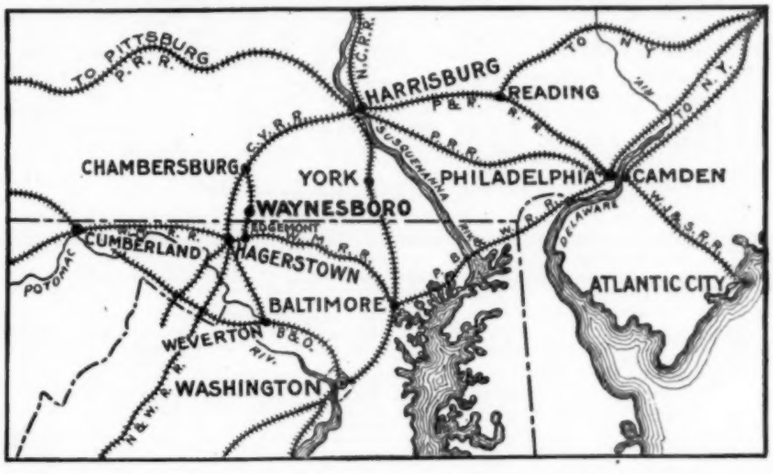

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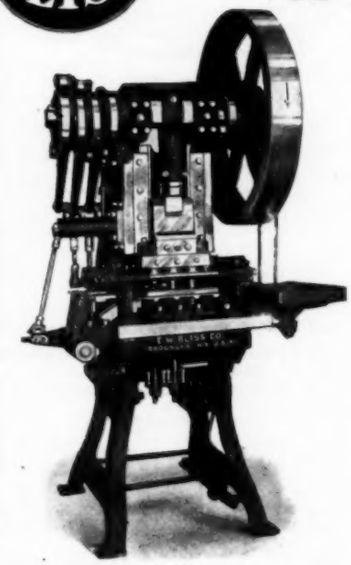

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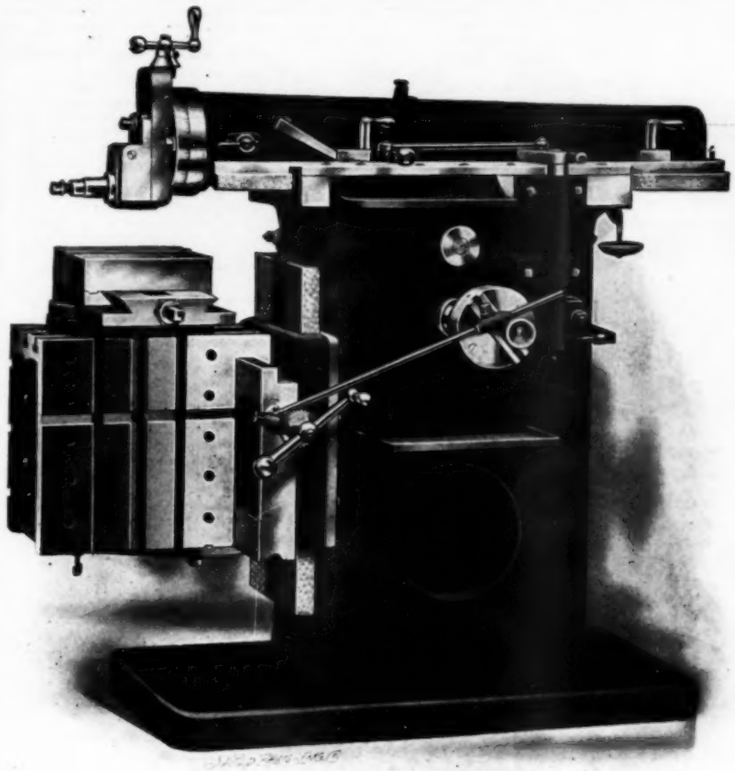

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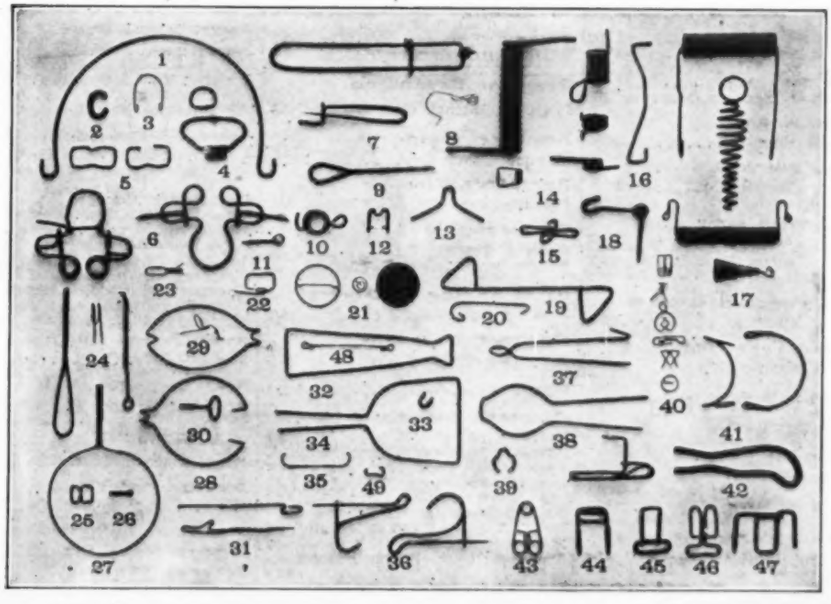

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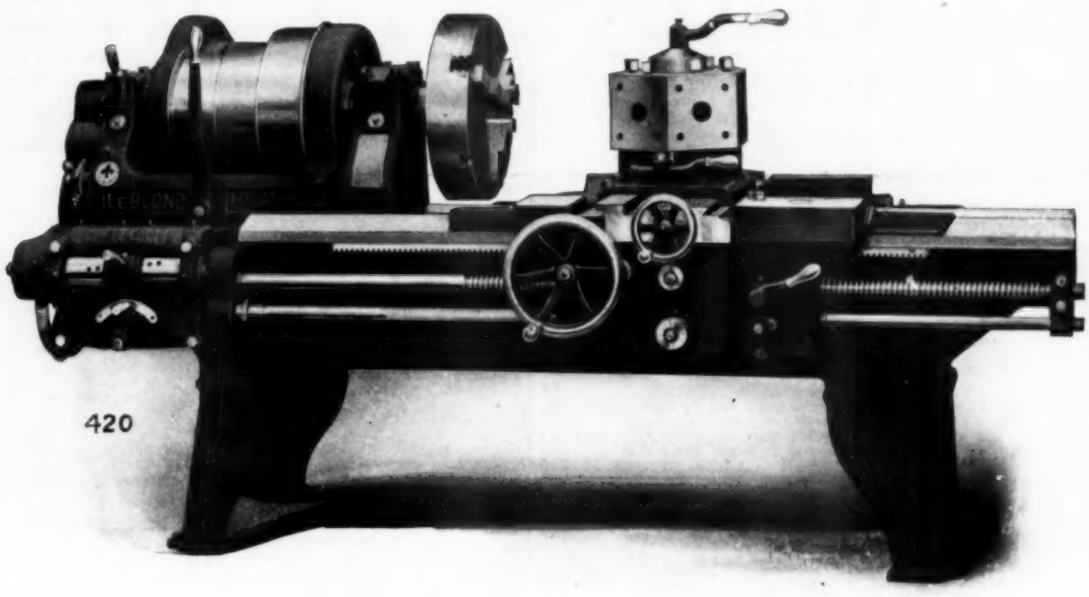

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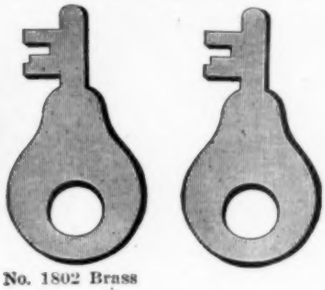
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